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An Archeological Overview and Management Plan for the Rocky Mountain Arsenal, Adams County, Colorado

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U.S. Army Materiel Development
and Readiness Command

by

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15. Supplementary Notes This report was prepared as part of the DARCOM Historical/Archeological Survey (DHAS), an inter-agency technical services program ro develop facility-specific archeological overviews and management plans for the U. S. Army Materiel Development and Readiness Command (DARCOM).

16. Abstract (Limit: 200 words)

The Rocky Mountain Arsenal in Adams County, Colorado, is an installation of the U. S. Departemnt of the Army's DARCOM Command. As a steward of approximately 17,000 acres of public lands, the arsenal has responsibility for the management of any cultural resources located within it. One archeological site is presently known to exist on the arsenal, but local geomorphology and culture history suggest that both prehistoric and historic cultural resources are likely to be found in the undisturbed portions of the Rocky Mountain Arsenal. Those sites possessing physical integrity will have high research value. In compliance with Army regulations AR 420, and with consideration of future ground disturbance activities planned for the arsenal, it is recommended that all presently undisturbed areas (8227 acres) of the arsenal be subject to archeological inventory and evaluation. Cultural resources should be located, recorded, evaluated, and assessment of eligibility for the National Register of Historic Places should be made for appropriate and significant sites. Archeological inventory data, together with historic architectural information, would then serve to help develop a facility historic preservation plan.

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MANAGEMENT SUMMARY

The following document is an archeological overview and management plan for the Rocky Mountain Arsenal. While only one archeological site is presently recorded at the arsenal, the local geomorphology as well as the cultural history of the surrounding area indicate that a variety of prehistoric and historic archeological resources are likely to occur in the undisturbed areas of the arsenal. Archeological sites with physical integrity found on the Rocky Mountain Arsenal are likely to have significant research value.

Compliance with the National Historic Preservation Act, the Archeological and Historic Preservation Act, 36 CFR 800, and draft Army regulations AR 420 requires the identification, evaluation, and where feasible, affirmative management of significant archeological resources. These also require that federal undertakings (e.g., new construction, new leases or lease renewals of public lands) take into consideration the effects of their proposed activities on these significant materials.

Thus, the first management recommendation of this report is that an archeological inventory and evaluation project be completed on all arsenal lands not known to have heavy modern ground disturbance (8227 acres). All archeological resources that are evident there should be located, recorded, and evaluated. Where appropriate, significant sites should be recommended for nomination to the National Register of Historic Places. These inventory data, when integrated with historic architectural information, would be the basis for developing a facility historic preservation plan. In lieu of completing such comprehensive inventory and evaluation, this report provides appropriate archeological management recommendations for planned land disturbance activities at the arsenal.

PREPARERS AND QUALIFICATIONS

John Montgomery of Nickens and Associates (Montrose, Colorado), prepared the following DARCOM overview and management plan for the Rocky Mountain Arsenal, Colorado. He has earned a BA (with honors), MA, and a PhD in Anthropology with emphasis in Southwestern archeology. During nine years of fieldwork, Dr. Montgomery has worked in the Southern Plains (Texas), south and west Texas, the northern Rio Grande Valley, southwestern Colorado, and the eastern Colorado plains. Dr. Montgomery has written or co-written five major cultural resource management reports and many smaller reports, as well as a monograph on his archeological research in south Texas.

ACKNOWLEDGEMENTS

Several persons helped prepare this document. At Rocky Mountain Arsenal, James Bucholtz and David Heim provided the specific information needed for this report. Glen Scott and Dr. Ted Hurr, both of the U S. Geological Survey, guided the author to the vast literature concerning the geology and water resources of the project area. Dr. Gordon C. Tucker, Jr. and Diana Christensen helped put together the environmental and paleoenvironmental sections, respectively. Sue Eininger calculated endless UTM coordinates and other map information.

Additional thanks go to Dr. Mark R. Barnes, Ms. Susan E. Garrett, NPS, SERO; Mr. Jack Rudy, NPS, RMRO; Ms. Mary Lee Jefferson, NPS, WASO; Ms. Barbara Sudler, SHPO, Colorado, and her staff, who reviewed the draft Rocky Mountain Arsenal document; and Ms. Zandra Dillion, Contracting Officer, NPS.

Final report production, including graphics, has been completed by Woodward-Clyde Consultants, with editorial review (particularly of management recommendations) and text preparation completed by Dr. Ruthann Knudson, Ms. Betty Schmucker, and Mr. Charles McNutt.

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FOREWORD

As a federal agency with large public land holdings, the U. S. Army is responsible for the stewardship of a variety of natural and cultural resources that are part of its installations' landscapes. The Army's Materiel Development and Readiness Command (DARCOM) presently manages a nationwide network of 65 installations and 101 subinstallations and separate units, which range in size from 1 acre to over 1 million acres. As part of its programs of environmental and property management, DARCOM has requested that the U. S. Department of the Interior's National Park Service provide technical guidance to develop programs for managing installation cultural resources.

NPS is thus conducting the DARCOM Historical/Archeological Survey (DHAS), which has two major disciplinary elements. The architectural review and planning function is being directed by the Service's Historic American Buildings Survey (HABS), while the prehistoric and historic archeological resource assessment and planning function is the responsibility of the Service's Interagency Resource Division (IRD). IRD has contracted with Woodward-Clyde Consultants (WCC) for the development of guidelines for the DARCOM archeological management planning effort, and for the completion of over 40 overviews and plans throughout the central United States. WCC has in turn subcontracted the technical studies to several regional subcontractors, with final editorial review of reports and preparation of text and illustrations handled by WCC.

This overview and recommended management plan for the archeological resources of the Rocky Mountain Arsenal was prepared by Nickens and Associates, Montrose, CO, under subcontract to WCC. It follows the guidance of "A Work Plan for the Development of Archeological Overviews and Management Plans for Selected U. S. Department of the Army DARCOM Facilities," prepared by Ruthann Knudson, David J. Fee, and Steven E. James as Report No. 1 under the WCC DARCOM contract. A complete list of DHAS project reports is available from the National Park Service, Washington, DC.

The DHAS program marks a significant threshhold in American cultural resource management. It provides guidance that is nationally applicable, is appropriately directed to meeting DARCOM resource management needs within the context of the Army's military mission, and is developed in complement to state and regional preservation protection planning (the RP3

process, through State Historic Preservation Offices). All of us participating in this effort, particularly in the development of this report, are pleased to have had this opportunity. Woodward-Clyde Consultants appreciates the technical and contractual guidance provided by the National Park Service in this effort, from the Atlanta and Washington DC offices and also from other specialists in NPS regional offices in Philadelphia, Denver, and San Francisco.

Woodward-Clyde Consultants — Ruthann Knudson

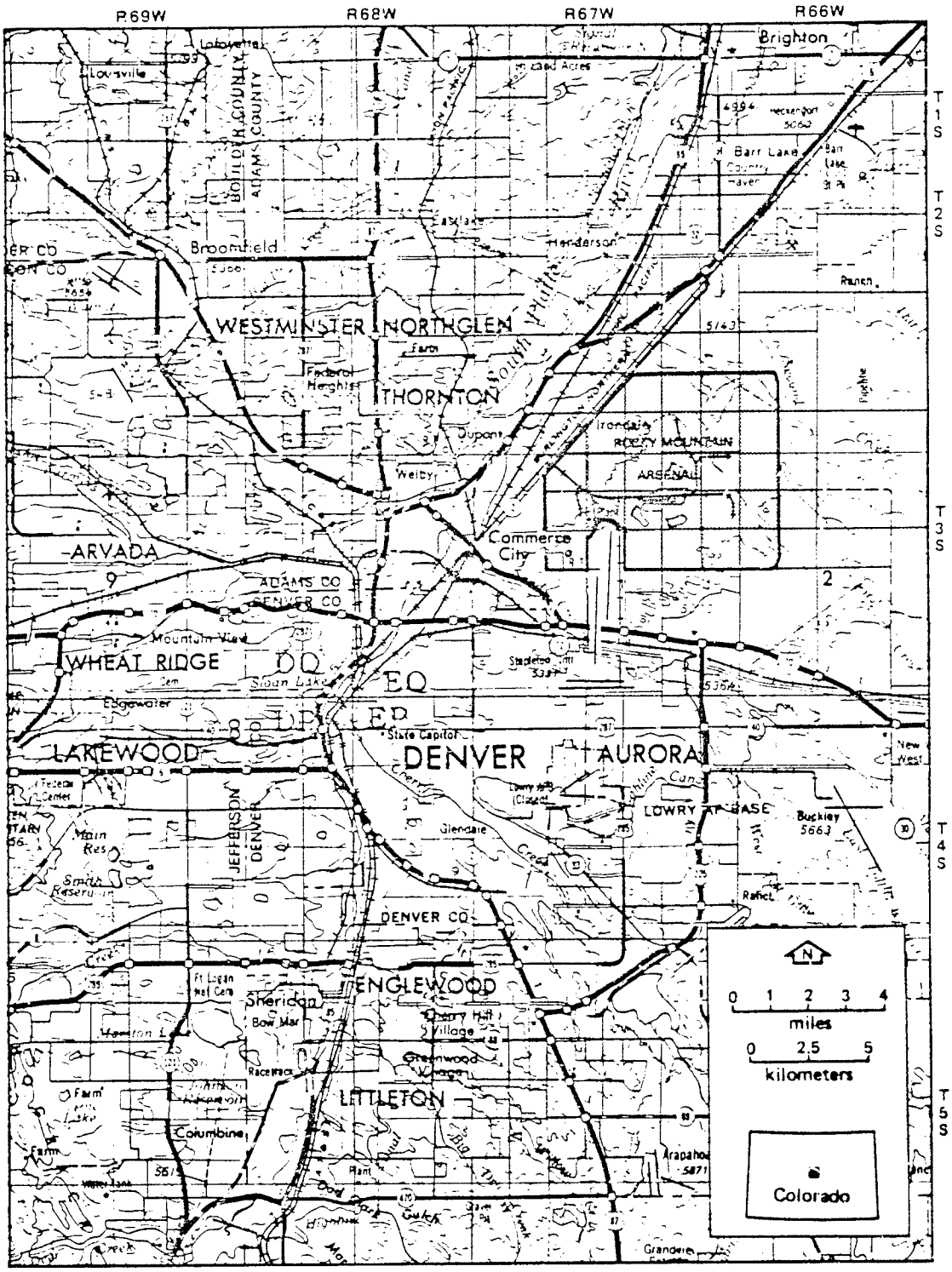
1.0 INTRODUCTION

The following report is an overview of and recommended management plan for the prehistoric and historic archeological resources that are presently known or likely to occur on the Rocky Mountain Arsenal in Adams County, Colorado (Figure 1-1). This facility is an installation of the U. S. Department of the Army DARCOM (Materiel Development and Readiness Command), which as a reservation of public land has responsibilities for the stewardship of the cultural resources that are located on it. The assessments and recommendations reported here are part of a larger command-wide cultural resource management program (the DARCOM Historical/ Archeological Survey, or DHAS), which is being conducted for DARCOM by the U. S. Department of the Interior's National Park Service. The following is that portion of the facility-specific survey that is focused on the prehistoric and historic resource base of the Arsenal, and was developed in accordance with the Level B requirements as set forth in the archeological project Work Plan (Knudson, Fee, and James 1983). A companion architectural study is in preparation by NPS's Historic American Building Survey (HABS), but is not yet available (William Brenner, personal communication 1984).

1.1 PURPOSE AND NEED

All DARCOM facilities must manage the cultural resources found within facility property. Several Federal laws and regulations set forth cultural resource management requirements. These include, but are not limited to, the following:

- The National Historic Preservation Act of 1966 as amended (80 Stat. 915, 94 Stat. 2987; 16 USC 470) requires inventory, evaluation, and nomination (where appropriate) of significant archeological properties controlled or owned by a DARCOM agency to the National Register of Historic Places. This act also requires a DARCOM agency to consult with the Advisory Council on Historic Preservation before conducting any ground-altering activity that may affect those significant properties. The agency must take into account the project's effect on any National Register-listed or eligible property and is directed to complete an appropriate data recovery program before such a site is damaged or destroyed.



Note: Base map is the USGS Denver, Colorado (1983) 1:250,000 topographic sheet

Figure 1-1. MAP OF THE GENERAL VICINITY OF THE ROCKY MOUNTAIN ARSENAL

- Executive Order 11593 (35 FR 8921) places leadership in the preservation of national cultural resources on the Federal agencies controlling those cultural resources. This insures that all cultural resources on an agency's property are protected. The Federal agencies are responsible for identifying, evaluating, and nominating (where appropriate) to the National Register of Historic Places all cultural resources found on their land.

- The Archeological and Historic Preservation Act of 1974 (88 Stat. 174, 16 USC 469) requires a Federal agency to notify the Secretary of Interior of any agency project which will destroy a significant archeological site. The Secretary or the notifying agency may support data recovery programs to preserve the resource's information.

- The Archaeological Resources Protection Act of 1979 (93 Stat. 721, 16 USC 470aa) establishes criminal and civil penalties for anyone damaging archeological resources on DARCOM property. This act also allows the Secretary of the Army to issue excavation permits for archeological resources on DARCOM lands.

- 36 CFR 800, Protection of Historic and Cultural Properties (44 FR 6068; as amended May 1982), sets forth the procedures for complying with Section 106 of the National Historic Preservation Act.

- Regulations from the Department of the Interior for determining site eligibility for the National Register of Historic Places (36 CFR 60, 36 CFR 63), and standards for data recovery (proposed 36 CFR 66).

- United States Department of the Army procedures and standards for preserving historic properties (32 CFR 650.181-650.193; Technical Manual 5-801-1; Technical Note 78-17; Army Regulation 420); and procedures implementing the Archeological Resources Protection Act (32 CFR 229).

These and other federal, state, and local regulations require management of cultural resources at the national level and at the level of the DARCOM facility. An effective way to comply with these regulations and guidelines is to include cultural resource managers in DARCOM facility planning activities. Efficient management of DARCOM facility cultural resources occurs when the cultural resources are known and potential land-moving effects are identified and evaluated during project planning.

1.2 THE ROCKY MOUNTAIN ARSENAL

Rocky Mountain Arsenal currently administers 17,152 acres in Adams County, Colorado. The arsenal is located 10 miles northeast of the center of Denver, Colorado and immediately north of Stapleton International

Airport (Figure 1.1). Modern military activities at Rocky Mountain Arsenal began in 1942 when the United States government acquired (from local farms) 19,776 acres of primarily agricultural land. The arsenal's initial mission was to produce chemical and incendiary munitions. Its current mission is twofold:

- the demilitarization of chemical weapons
- the control of off-base migration of potential contaminants produced by demilitarization activities.

A brief history of Rocky Mountain Arsenal's activities is found in the Environmental Impact Statement for the Expanded North Boundary Containment Operations (Campbell 1980:17-21). Detailed information concerning changing land-use patterns at the arsenal is available in the multivolume History of the Rocky Mountain Arsenal (Anonymous n.d.).

The current array of buildings and special use areas at Rocky Mountain Arsenal is shown in Figure 1.2. Buildings on the arsenal have been divided into several groups, as follows.

Group 1: The South Plant area, a set of buildings, warehouses, storage bunkers, railroad tracks.

Group 2: A large storage area containing general storage warehouses, storage bunkers, railroad tracks, and a toxic gas yard.

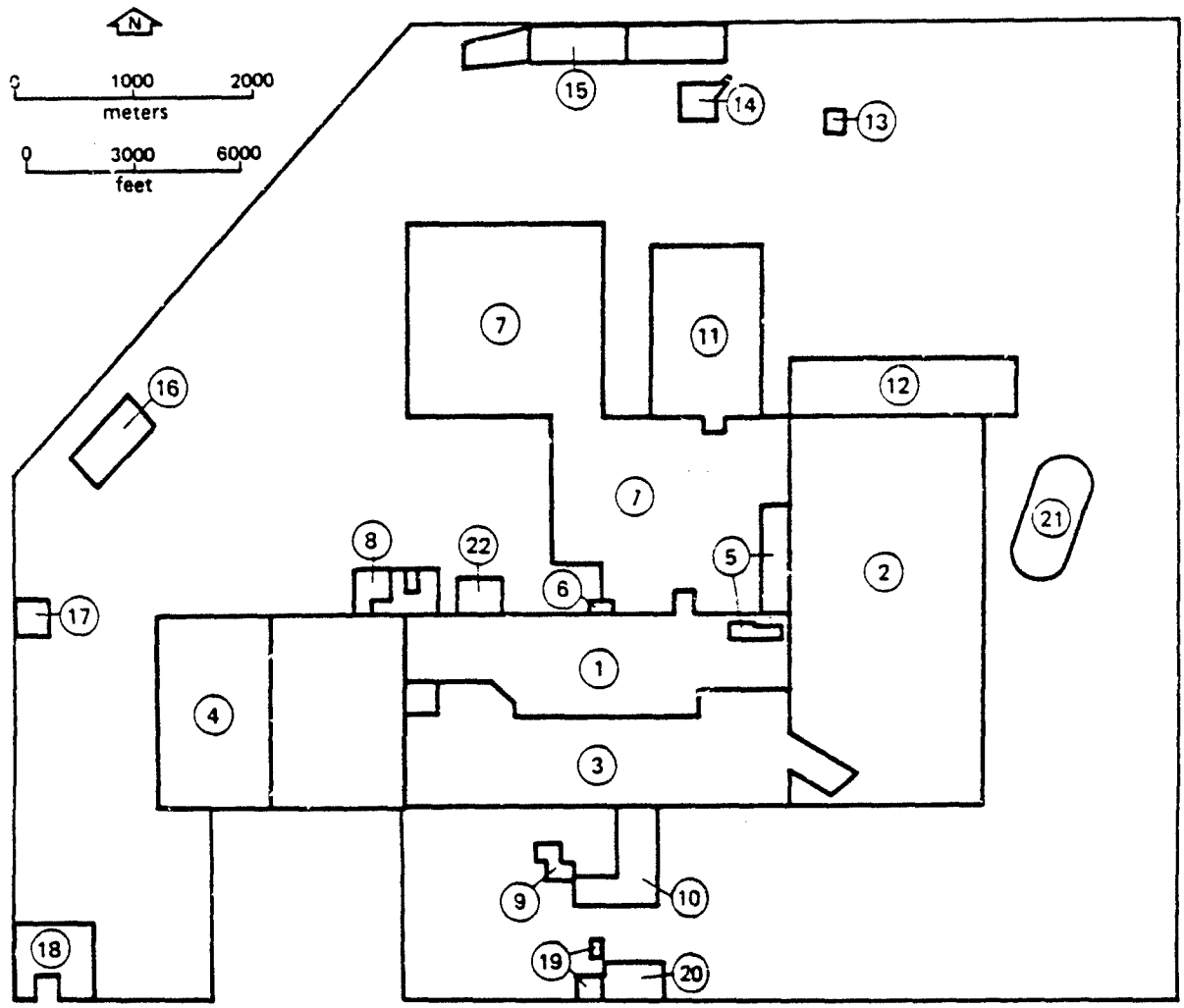
Group 3: A water storage area composed of four lakes (Upper and Lower Derby Lake, Ladora Lake, and Lake Mary), that have been enlarged somewhat and modified by Rocky Mountain Arsenal; the modifications consisted primarily of raising and strengthening the dikes holding the water.

Group 4: A warehouse area which contains general warehouse storage buildings, automotive storage garages and repair shops, flammable material storehouses, and an oil pump house.

Group 5: Two hydrazine areas containing a set of railroad tracks, a liquid petroleum storage facility and fuel storage tanks; both areas are fenced and reinforced.

Group 6: A fire station facility with two structures; a fire station headquarters and a much smaller accessory shed.

Group 7: A large contaminated waste area with several waste facilities. Five large depressions have been hollowed out and used for contaminated waste disposal and storage. These depressions are Basin "A," Basin "B," and Reservoirs "C," "D," "E," and "F." Two drainage canals link Basin "A" with Basin "B" and Basin "B" to Reservoir "D" and the Sand Creek Lateral links Reservoir "C" and Reservoir "F" to



LEGEND

01. South plant area
02. Storage area
03. Water storage area
04. Warehouse area
05. Hydrazine areas
06. Fire station
07. Contaminated waste area
08. Housing units, recreational area
09. Recreational area
10. Special use area
11. North plant
12. Contaminated area
13. Recreational area
14. Sewage treatment plant
15. Aquifer containment/treatment area
16. Irondale treatment facility
17. Administration area
18. United States Post Office
19. Recreational area
20. AMSA/OM Maintenance building
21. Contaminated area
22. Headquarters area

Figure 1-2. MASTER BASE MAP OF THE ROCKY MOUNTAIN ARSENAL

the Lake Ladora system. Trash sites, bomb test buildings, a disposal well, and industrial treatment facilities are also located in this area.

Group 8: Non-commissioned-officer (NCO) family housing units, Batchelor officer quarters (BOQ) and troop housing quarters, and an adjacent recreational area. The NCO family housing is a trailer park area currently unoccupied, and three renovated farmhouses. The BOQ and troop housing area is being demolished. There is a tennis court and a cleared playing field.

Group 9: A recreational area which has an officers' eating facility, a swimming pool and support buildings, and an officers' residence and garage.

Group 10: A special use area with a building previously used for the rod and gun club, a rifle range (with two berms), and a large area set aside for picnicking.

Group 11: The North Plant, a fenced-in area containing a set of railroad tracks, chemical munitions production and fill plants, storage vaults, scrubbers and decontamination buildings, fuse detonation magazines, ammunition demolition facilities, cluster assembly plant, general warehouses, and a dispensary.

Group 12: A "contaminated" area with only one maintenance building and a series of dirt roads; contaminated materials are buried in this general area and recent aerial photographs indicate where areas have been filled.

Group 13: A small area in the northern portion of the arsenal with a small pistol range flanked by two berms and a small shed nearby.

Group 14: A sewage treatment plant with two Imhoff tanks, a monitoring building, a pool, and two drainage ditches.

Group 15: A set of wells of an aquifer containment/treatment area with a ground water industrial treatment building.

Group 16: The Irondale treatment facility, a water treatment building and water wells.

Group 17: The administration area with a sentry gate, two security buildings, and a large visitor parking lot.

Group 18: A Postal Service facility on property permitted from the Rocky Mountain Arsenal; is one large building with two parking lots.

Group 19: A recreational area located next to the projected AMSA/OMS building (see below); it is a cleared area with picnic tables.

Group 20: The AMSA/OMS Maintenance Building, constructed in 1983, which provides maintenance support for the Army Reserve.

Group 21: An area previously used for impact area during test firing of munitions.

Group 22: The Rocky Mountain Arsenal Headquarters Area with two communications buildings, the administration headquarters building, and a connecting roadway.

1.3 SUMMARY OF PREVIOUS ARCHEOLOGICAL WORK

No archeological fieldwork (survey and/or excavation) has occurred on the Rocky Mountain Arsenal property or on areas bordering the arsenal. Almost all areas west or south of the arsenal have been converted to residential and/or industrial buildings, with a corresponding loss of any archeological resources that might have been there. Agriculture continues to be the primary land-use activity north and east of the facility, but continuing urban expansion will affect these agricultural areas soon.

One result of the urban growth in this region of Colorado is that few archeological sites have been located and investigated on the Plains. Most of eastern Colorado archeology relies heavily on the chronology, projectile point typology, other items of material culture, and subsistence information obtained by analyzing excavated archeological sites in the foothills of the Rocky Mountains. A complete account of regional prehistory must include information obtained from archeological sites located on the Plains.

The only archeological site recorded on the Rocky Mountain Arsenal is 5AM185, a disturbed lithic scatter with fragments of ground stone, flakes, fire-cracked rock, and hammerstones (Johnson 1982). This site is difficult to date because it lacks temporally diagnostic stone tools. Johnson (1982) believes the site may be Archaic and date between 3500 and 1000 BC. Examination and recording of 5AM185 occurred because a gravel pit threatened to destroy the site and an arsenal employee alerted the Rocky Mountain Arsenal Environmental Engineer, who in turn requested technical assistance from the National Park Service.

1.4 THE SOCIOCULTURAL CONTEXT OF THE ARCHEOLOGICAL RESOURCES ON THE ROCKY MOUNTAIN ARSENAL

Archeological resources found on the Rocky Mountain Arsenal are important to many groups of people. Scientists and members of the public who study prehistory will consider the archeology of the Rocky Mountain Arsenal to be of crucial importance in preparing a prehistory of the Colorado Plains region. The possible resources on the arsenal's property could be important to those Euroamericans who initially homesteaded in the area but had to move when the arsenal was commissioned. Older homes

on the arsenal property may have architectural details or history which would be important to historic preservationists. While the Native American tribes that inhabited eastern Colorado (e.g., Arapaho) no longer live in the area, any archeological sites associated with these people would be potentially significant from a religious and/or cultural standoint.

2.0

AN OVERVIEW OF THE CULTURAL AND RELEVANT NATURAL HISTORY OF THE ROCKY MOUNTAIN ARSENAL

2.1 THE PHYSICAL ENVIRONMENT

This section is a description of the earth, water, climatic, plant, and animal resources of the modern environment that were probably available for human use during the historic period. This description is intended as a baseline against which interpretations of paleoenvironmental conditions can be compared.

2.1.1 Earth Resources

The Rocky Mountain Arsenal is located in the Colorado Piedmont section of the Great Plains physiographic province (Fenneman 1931). The Colorado Piedmont is a broad and shallow basin formed about 28 million years ago when erosion stripped off pre-Tertiary sediments from an area near the mountains. Most of these sediments were stripped away by the South Platte River and its tributaries as these drainages were diverted (by tectonic uplift) northward from their original east-flowing routes. Erosion also has exposed the upper edges of uptilted Paleozoic and Mesozoic sediments (limestone, shale, and sandstone); these strata now form hogbacks alternating with low, smooth swales. East of the mountains, the valleys are "wide flat-floored terrace-bordered channels occupied by quiet, braided streams, that flow over thick deposits of fine- to medium-grained alluvium" (Scott 1963:4). Valley size is generally proportional to the size of the streams that cut them.

The project area is underlain by two principal geologic units: bedrock and Quaternary surficial deposits. The bedrock on which the surficial deposits rest is the Denver Formation of Upper Cretaceous and Paleocene age (Hunt 1954). This formation consists of conglomerate, sandstone, siltstone, and clay. Isolated exposures of the Denver Formation occur in two localities at the Rocky Mountain Arsenal, in the northeast corner adjacent to First Creek and just east of Reservoir "F" under the North Plant (Trimble and Machette 1979).

The stratigraphic relationships of the Quaternary deposits in the project area, and their correlation with similar depositional sequences

from the Front Range, are shown in Table 2-1. This stratigraphic sequence can be subdivided into three major deposits: Pre-Wisconsin, Wisconsin, and Pecent. The descriptions of these deposits are derived from Hunt (1954).

The Wisconsin deposits consist of alluvial gravel, eolian deposits, a soil zone, and gravel fill and alluvium. The alluvial gravel is Early Wisconsin in age and corresponds to the Louviers Alluvium which has been dated at 10,200 ± 350 years B.P. in the Kassler Quadrangle (Scott 1963). This deposit probably represents outwash from Front Range glaciers and is believed to have been at least 55 feet thick. It includes many vertebrate remains, including horse, mammoth, camel, and bison. Some of the bone fragments appear to have been split by human action, a possibility supported by the occurrence of a few chert flakes in the same deposit. The eolian deposits consist of sand laid down in Early Wisconsin time by winds blowing from the west and southwest. These eolian materials, undifferentiated from Recent sand, comprise most of the surficial deposits on the Rocky Mountain Arsenal (Trimble and Machette 1979). A few vertebrate remains (camel, mammoth, horse, and rodents) have also been found in this deposit. A soil developed on these eolian deposits and separates the eolian deposits from the overlying gravels and alluvium. This alluvium, composed mostly of clay and silt, corresponds to the Broadway alluvium which forms a broad terrace along the east side of the south Platte River (Scott 1963; Trimble and Machette 1979). It is derived from the erosion of deep, clayey pre-Wisconsin soils which mantled the upland areas. Vertebrate fossils found in this deposit include camel, bison, and antelope.

Geological deposits of Recent age include eolian sand, Piney Creek alluvium, soil, and floodplain alluvium. The eolian sand was derived from reworking of the Wisconsin eolian deposits, probably by winds which relict dunal ridges indicate blew from the northwest. Where evidence of prevailing wind direction is absent, the Recent eolian sand is difficult to distinguish from the Pleistocene sand. However, eolian deposits of late Pleistocene-early Recent age, do comprise the greatest proportion of the surficial deposits of the Rocky Mountain Arsenal. Overlying these eolian deposits at certain locations is the Piney Creek alluvium. This alluvium is mostly silt but contains many thin layers of silty sand and gravel. This deposit forms a low terrace along the South Platte River and was deposited on its valley floor by tributaries rising on the adjoining uplands; First Creek (Figure 1-1) is one such tributary, albeit minor. Osteological remains taken from the Piney Creek alluvium include bison, antelope, deer, lagomorphs, and rodents. Along the Front Range abundant archeological materials have been found in these deposits, including hearths, groundstone, and chipped stone. Charcoal from one of the hearths was radiocarbon-dated at 1150 ± 150 BP (AD 800), placing the occupation of the site within the Plains Woodland period (Scott 1963).

Young (i.e., historic) alluvial deposits are found along the floodplains of the South Platte River and its major tributaries. They have

Table 2-1. CORRELATION OF QUATERNARY DEPOSITS OF COLORADO AND NEBRASKA WITH DEPOSITS OF THE KASSLER QUADRANGLE

Date	Scott 1963 Kassler, CO	Malde 1955 Louisville, CO	Hunt 1954 Denver, CO	Schultz and others 1951 Nebraska
Recent	Loess and eolian sand[b] Post-Piney Creek alluvium[a,b] Late Recent soil[c] Piney Creek alluvium[a] Early Recent soil[c] Eolian sand Pre-Piney Creek alluvium[a,b]	Post-Piney Creek alluvium Recent soil Piney Creek alluvium and colluvium	Flood-plain alluvium[a] Recent soil Piney Creek alluvium[a] Eolian sand[a]	Soil Z[a] Silt and loess[a] Soil Z[a] Cochrane silt and loess[a,b] Soil Y[a]
Wisconsin	Broadway alluvium Wisconsin soil[c] Younger loess Louviers alluvium[a,b] Sangamon (?) soil[c] Older loess	Gravel fill and alluvial fill Wisconsin soil Eolian silt and sand Cobble gravel Pre-Wisconsin soil	Gravel fill[a] and alluvium along Lakewood and Wier Gulches[a] Wisconsin soil Eolian deposits[a] Alluvial gravel[a] Pre-Wisconsin soil Undifferentiated upland deposits	T2A fill Soil YY Bignell soil T2Bfill Soil X Brady soil Silt and loess Soil W Todd Valley formation Sangamon soil[a] Loveland formation[a] Residuum
Pre-Wisconsin	Slocum alluvium[a] Yarmouth (?) soil[c] Verdos alluvium Silt and volcanic ash	Upland gravel Aftonian (?) soil[c] Rocky Flats alluvium	Gravel on hilltops west of Platte River Gravel on Rocky Flats	Crete formation[a] Yarmouth soil Sappa formation[a] Pearlette ash Grand Island formation[a] Red Cloud Formation[a] Aftonian soil Fullerton formation Holdredge formation

SOURCE: Scott 1963:62

[a] Fossil bone reported.
[b] C_{14} samples analyzed.
[c] Age term.

been traced up some of the smaller steams and overlie the Piney Creek alluvium but their lithologic boundaries have not been mapped. These younger alluvial deposits generally are coarser in texture than the Piney Creek and Pleistocene alluvia, and include gravel layers and sand beds with only minor amounts of silt and clay.

As the above discussion indicates, the modern landscape surrounding the Rocky Mountain Arsenal results from a combination of geological events which laid down numerous deposits of different thickness and composition. The Quaternary deposits contain fossil remains that provide important clues about local environmental conditions. Many of these fossil bones exhibit evidence of human modification which, when coupled with other evidence such as chipped stone artifacts, indicate that human populations have inhabited the area for millenia. Distinctive artifactual assemblages are associated with particular geological strata, a relationship which has assisted geologists in dating some of these strata. An understanding of the depositional sequence provides clues to the kinds and numbers of cultural remains which one would expect to find within a particular geological stratum. For example, the eolian deposits could contain Paleo-Indian materials because some of these deposits were laid down during the late Pleistocene. It is equally possible for these deposits -- particularly the upper levels -- to contain artifacts of more recent age. We would not expect, however, the Piney Creek alluvium to contain 10,000 year-old cultural materials (unless they were removed by erosion from their original location and redeposited) since the geological stratum postdates the cultural materials.

Knowing the composition of the geological deposits could assist in understanding which deposits were exploited as a raw material source for lithic tools. The Louviers alluvium, which corresponds to the local early Wisconsin alluvial gravel, contains fragments of quartz, welded tuff, and chert, all of which could have been fashioned into tools. The Late Wisconsin gravel fill and alluvium, corresponding to the Broadway alluvium, is composed primarily of welded tuff and quartz, with lesser amounts of chert and quartzite. These two deposits could have supplied most of the raw materials for prehistoric lithic technological activities. Some of the other lithic materials probably came from more distant sources. The rocks lining some of the hearths discovered in the area were made of such pre-Quaternary materials as sandstone from the Permian Lyons Formation and Precambrian metamorphic gneiss; suitable fragments of these materials probably originated at outcrops near the mountain foothills.

These geological deposits have played a major role, in conjunction with climate, in the development of the local soils. Four major soil associations have been identified in the project area: The Ascalon-Vona-Truckton Association, the Alluvial Land Association, the Blakeland-Valent-Terry Association, and the Platner-Ulm-Renshill Association (Sampson and Baber 1974). Each of these is described briefly below.

The Ascalon-Vona-Truckton Association includes more than half of the local soils, most of which are located more or less in the southwestern portion of the Rocky Mountain Arsenal. It occurs on uplands and adjacent to large streams and creeks east of the South Platte River; First Creek is the only such stream which flows through the project area. The soils are loamy and sandy and are formed in wind-laid deposits (Pleistocene and Recent eolian sands); they are well-drained to somewhat excessively drained.

The Alluvial Land Association occurs in bottom lands along streams and creeks, the local example being, of course, First Creek. These are loamy and sandy soils formed in stream and river deposits (Piney Creek alluvium). They are poorly drained to well-drained.

The Blakeland-Valent-Terry Association occurs on uplands east of the South Platte River; they are confined to a small area in the northern end of the project area. They are sandy soils which are somewhat excessively drained.

Finally, the Platner-Ulm-Renshill Association comprises the second largest area on the Rocky Mountain Arsenal. These soils are found on higher upland areas and are formed on old (pre-Wisconsin) alluvial wash materials, resting on interbedded shale and sandstone (Denver Formation). They are well-drained.

Each soil association could support certain vegetational communities, water resources, and local faunal. Table 2-2 summarizes the suitability of these soil associations for wildlife habitat. It would appear that the Alluvial Land Association along First Creek is more likely to provide or have provided suitable food, cover, and water for local wildlife than any other soil association.

2.1.2 Water Resources

Few natural water resources that might have been available for prehistoric consumption exist in the project area. The major water source in the area is the South Platte River, located a few miles west of the Rocky Mountain Arsenal. The surface-water inflow for this perennial drainage, as measured at Denver for the period 1928-1958, is 223,000 acre-feet/year (Smith, Schneider, and Petri 1964), and would have provided all the water any prehistoric group would have needed. However, the water is of poor quality, highly mineralized, and very hard (200 ppm of calcium and magnesium), and it contains high concentrations of sulfate (Smith, Schneider, and Petri 1964). Of course, these assessments of water quality may have little bearing on the suitability of the water for prehistoric populations. The only natural surface stream which flows through the Rocky Mountain Arsenal is First Creek, a small drainage that originates southeast of the arsenal and flows in a northwest direction across the arsenal. That water has flowed with some force in First Creek is documented by the alluvial deposits (Piney Creek alluvium) contained within its channel. Water flows in First Creek after heavy rainfall, but it would not have been a dependable source of permanent water.

Table 2-2. SUITABILITY OF SOIL ASSOCIATIONS FOR WILDLIFE HABITAT

Soil Association	Kinds of Wildlife[a]	Suitability[b]		
		Food	Cover	Water
(3) Ascalon-Vona-Truckton	Open Land	1	4	4
	Upland	1	1	3
	Fish	4	4	4
(5) Alluvial Land	Upland	1	2	1
	Woodland	2	2	1
	Wetland	1	1	1
	Fish	4	4	3
(7) Blakeland-Valent-Terry	Open Land	1	4	4
	Upland	1	1	3
(9) Platner-Ulm-Renshill	Open Land	1	4	4
	Upland	1	1	3
	Wetland	1	1	3
	Fish	4	4	3

Source: Sampson and Baber 1974: Table 5.

[a] Kinds of Wildlife: Open land - antelope and jackrabbit; Upland - cottontail rabbit, game birds; Woodland - mule deer; Wetland - ducks and geese.

[b] Suitability: 1, well suited; 2, moderately well suited; 3, poorly suited; and 4, not applicable.

Water for modern consumption and irrigation is obtained principally from groundwater reserves. Groundwater flow is contained in the alluvial sediments above the Denver Formation and flows in a northwesterly direction to the South Platte River following a buried drainage system (Campbell 1980). At times, the groundwater surfaces along First Creek, in the bog near the northern boundary of the Rocky Mountain Arsenal, and in Basins "A" and "B." The latter, as well as Basins "D" and "E," are natural depressions which have been dammed to increase storage capacity in the area. The Derby Lakes, Lake Ladora, and Lake Mary are artificial reservoirs which are recharged by an irrigation canal.

2.1.3 Modern Climate

The project area is located within a semiarid High Plains climate. Table 2-3 summarizes temperature and precipitation normals, means, and extremes for the Weather Bureau Office at Stapleton International Airport which borders part of the Rocky Mountain Arsenal's southern boundary (Campbell 1980). These values can be compared with those obtained from weather stations at Denver (U. S. Department of Agriculture 1941:798) and at Byers in Arapahoe County (Sampson and Baber 1974:69). The average daily minimum and maximum temperatures at Byers are 35° F. and 66° F., respectively. It receives slightly more than 14 inches of precipitation annually, with May being the wettest month and December the driest. Byers receives 46 inches of snow per year and the growing season is 150 days. At Denver, the average January temperature is 32° F. while the average July temperature is 72.5° F. The city receives approximately 14 inches of precipitation per year and April and January are the wettest and driest months, respectively. Annual snowfall measures 59 inches and the growing season is 171 days.

Variations in climate from the western end of Adams County eastward may be summarized as follows (Sampson and Baber 1974:69): increased average windspeed; slightly lower average annual precipitation; lower amounts of precipitation and snowfall in winter and early spring; increased amounts and variability of summer precipitation; greater average variation in daily and annual temperatures; and somewhat less cloudiness and higher percentage of sunshine.

2.1.4 Plant Resources

Rocky Mountain Arsenal is located within the Northern Temperate Grassland, as defined by Shelford (1974). Within this biome are three major biotic regions: combined tall-grass and mixed grassland, short-grass, and bunch-grass; the project area is encompassed within the short-grass region.

The short-grass grassland was originally covered by blue grama (Boutela gracillis) and buffalo grass (Buchloe dactyloides). Shelford (1974) also includes Galleta-grass (Hilaria jamesii) in this original grassland community, but Weber (1972:374) notes that this grass is common in western Colorado while rare along the Front Range. Pasture sagebrush

Table 2-3. TEMPERATURE AND PRECIPITATION NORMALS, MEANS, AND EXTREMES RECORDED AT STAPLETON INTERNATIONAL AIRPORT*

Month	Temperature (F°)				Precipitation (In.)		
	Normal Daily Max	Normal Daily Min	Record Highest	Record Lowest	Normal Monthly	Max Monthly	Mean Monthly Snow
January	43.5	16.2	69	-25	0.61	1.44	8.2
February	46.2	19.4	76	-18	0.67	1.65	7.9
March	50.1	23.8	84	- 4	1.21	2.89	12.7
April	61.0	33.9	84	- 2	1.93	4.17	9.9
May	70.3	43.6	93	26	2.64	7.31	1.6
June	80.1	51.9	98	36	1.93	4.69	Trace
July	87.4	58.6	103	43	1.78	6.41	0.0
August	85.8	57.4	100	41	1.29	4.47	0.0
September	77.7	47.8	97	20	1.13	4.67	1.8
October	66.8	37.2	87	3	1.13	4.17	3.7
November	53.3	25.4	78	- 2	0.76	2.97	7.9
December	46.2	18.9	73	-18	0.43	2.84	6.4
YEAR	64.0	36.2	103	-25	15.51/yr	7.31	61.0/yr

Source: Campbell 1980:27

(Artemesia frigida) was very common and widespread on gravelly hillsides. Forbs consisted of pasque flower (Pulsatilla patens), butterweed (Senecio aureus), copper mallow (Sphaeralcea coccinea), aster (Aster ericoides), blazing star (Hiatris punctata), and smooth goldenrod (Solidago missouriensis).

These plants provided forage for the resident herbivorous animals hunted by the prehistoric groups. Many of the plants were probably important to these groups for ethnobotanical reasons. Information is absent on the ethnobotany of the Indian groups which occupied the region in historic times. Gilmore (1977) writes of the use by other aboriginal groups of the same plant species which are found in the project area. The Indians of the Missouri River region used many of the native plant species in the project area for medicinal or ceremonial purposes. Prairie sagebrush was "women's medicine" among the Dakota, a "decoction used for bathing and taken internally by women when menstruation was irregular"; among the Omaha-Ponca, it was referred to as "little gray herb" (Gilmore 1977:82). The pasque flower, called "twin flower" by the Dakota, was used by the Dakota, the Omaha, and other groups as a "counter-irritant for...rheumatism and similar diseases. The fresh leaves of Pulsatilla are crushed and applied on the surface over the affected part... to cause a blister. It is not to be taken internally" (Gilmore 1977:29-30). The copper mallow, known as "medicine of the Heyoka (a dramatic order among the Dakota)", was used by chewing it to a paste, which was rubbed over hands and arms,

> thus making (the Heyoka) immune to the effect of scalding water, so that to the mystification and wonderment of beholders these men were able to take up pieces of hot meat out of the kettle over the fire. The plant was also chewed and applied to inflamed sores and wounds as a cooling and healing salve (Gilmore 1977:51).

The Omaha-Ponca would chew some blazing star and blow it into the nostrils of their horses to help them run better. A decoction of the same plant was made up by the Pawnee and given to children for diarrhea (Gilmore 1977:81-82). Finally, goldenrod was "used by Omaha as a mark or sign in their floral calendar...its time of blooming synchronous with the ripening of corn" (Gilmore 1977:81).

This native grassland has been significantly modified in modern times. An ecological survey conducted in 1975 identified 10 major vegetation cover types on the Rocky Mountain Arsenal (Arthur D. Little, Inc. 1980:G-4). Three of these vegetation types account for 75 percent of the total acreage on the Rocky Mountain Arsenal: Early Successional, Crested Wheatgrass, and Sand Dropseed. The Early Successional is weedy vegetation, including forbs and grasses, found in recently disturbed areas. Crested Wheatgrass is an introduced species which was planted for soil stabilization. The Sand Dropseed is a successional stage midway between the early successional and climax stages and is dominated by sand dropseed (Sporobolus cryptandrus). The remaining vegetation types consist of

Grasses (needle-and-thread, western wheatgrass, red three-awn, and blue grama), Marsh (along First Creek, canals, lakes, ponds and other low-lying moist areas), Woodland (various trees planted around buildings and along roadways), and Thicket (black locust, planted by the original land owners, and willows along water courses). In general, the aerial survey identified 228 different plant species at the arsenal.

2.1.5 Animal Resources

Under native conditions the Short-Grass Grassland biotic region of the Northern Temperate Grassland was populated by herbivores, lagomorphs, rodents, carnivores, and birds (Shelford 1974). The herbivores included bison and pronghorn. Early Euroamerican explorers reported herds of a million or more bison in this region during the nineteenth century. These herds preferred the open grasslands, moving north in summer and south again in early winter. Pronghorn (American antelope) also occurred in great numbers. These ungulates preferred rolling topography and south shelter in ravines and cottonwood-covered valleys during storms. More restricted in their migratory habits than were bison, pronghorn would move during winter to areas where the snow was thin.

Lagomorphs included the white-tailed jack rabbit and the desert cottontail; both were numerous throughout the area. Various species of burrowing rodents abounded in the area. These included ground squirrels, pocket gophers, and mice. The rabbits and rodents were preyed upon by different carnivores, including coyotes, wolves, foxes, badgers, skunks, and weasels. Avian species included various perching birds, the lesser prairie chicken, and burrowing owls. Other raptors such a hawks were not numerous. Reptiles consisted almost entirely of snakes, including the plains garter snake, western rattlesnake, and the bullsnake.

Recent ecological studies (Arthur D. Little, Inc. 1980) indicate that many faunal species inhabit the arsenal. These include 29 species of mammals: deer (mule and white-tailed), rabbits (black-tailed jack-rabbit and desert cottontail), rodents (ground squirrels, pocket gophers, prairie dogs, mice, and moles), and carnivores (coyote, badger, weasel, skunk, and raccoon), About 190 species of birds have been reported on the Rocky Mountain Arsenal. The western meadowlark is the most abundant resident bird. A unique characteristic of the Rocky Mountain Arsenal, one which distinguishes the modern from the historic faunal populations, is the high density of raptorial species such as hawks and owls. Fish inhabit the permanent bodies of water and 14 species have been identified on the arsenal. Sixteen species of amphibians and reptiles, including snakes, salamanders, and frogs, are found throughout the project area.

2.1.6 Paleoenvironment

The reconstruction of the paleoenvironment of east central Colorado is limited because no detailed collection of applicable evidence has been conducted for this specific area. Data from adjacent areas such as the Laramie Basin in southeastern Wyoming, the Llano Estacado of the Texas

Panhandle and the pollen and alluvial sequences of Kansas and Nebraska are used to reconstruct the paleoenvironment of east central Colorado (Table 2-4).

In general, the data indicate that from the final end of the glacial period in the area (15,000 BP) to the present day, there ranged a span of time in which there occurred dramatically differing environments on the Central Plains of east central Colorado (Table 2-4).

2.2 The Cultural Environment

The major cultural-historical units and their associated temporal spans are listed in Table 2-5. Archeologists working in the Great Plains recognize four major prehistoric traditions, from early to late: Paleo-Indian, Plains Archaic, Plains Woodland, and Plains Village (Willey 1966). Local manifestations of the tradition are named phases, foci or complexes. For this discussion, each tradition is broken into segments of time, called periods. The area in question is the Foothills subarea of the Eastern Colorado Plains and Northeast Colorado Plains (Colorado Preservation Office 1983). The recent Eastern Colorado Plains archeological research design (Colorado Preservation Office 1983) was followed in this overview, since the final Colorado Plains research design (Eighmy 1984) was only available as this final report was being reproduced.

2.2.1 Prehistory

The cultural chronology of the eastern Colorado Plains begins with the Paleo-Indian tradition. This tradition is characterized by the association of humanly-made tools with the bones of now-extinct animals such as mammoth, large forms of bison, horse, and camels. While Paleo-Indian materials are most often associated with Pleistocene megafauna, it is quite probable that seasonal or opportunistic use of vegetal products and small game also characterized their adaptation.

The end of the Paleo-Indian tradition is marked by the dramatic loss of many large and small animal species and climate change. During the succeeding Archaic tradition, inhabitants of the eastern Colorado Plains were no longer large-game hunters and gatherers. With the advent of the Altithermal climatic episode (7000 BP), hotter and drier conditions prevailed over the Plains. The inhabitants of the Great Plains lived on a variety of small animals and plants. This shift in subsistence adaptation is mirrored by a technological shift. Different types of projectile points were used on darts for hurling at animals, and ground stone tools for grinding plant materials became an important part of the Archaic toolkit.

The first 2000 years of the Plains Archaic are not well documented on the Plains, due either to gaps in archeological research or to an abandonment of the area due to climatic change. The controversy continues

Table 2-4. A SUMMARY OF THE ENVIRONMENTAL HISTORY OF THE AREA OF THE ROCKY MOUNTAIN ARSENAL

Benedict 1975b (Indian Peaks) Geomorphology, Pollen		Wendland 1978 Eastern North America) Pollen, Archeology, Vegetation	
Date[a]	Inferred Climate	Date[a]	Inferred Climate
		100 BP to Present	Dry or very dry
300 to 100 BP	Reduced summer temperatures and decreased summer precipitation	400 to 100 BP	Generally cooler
950 to 300 BP	Warm and relatively moist		
		1260 to 850 BP	Somewhat moister
1850 to 950 BP	Heavy and persistent winter snowfall: vegetation zones slightly higher than now		
		1680 to 1260 BP	Somewhat moister
3000 to 1850 BP	Somewhat warmer and wetter than present	2760 to 1680 BP	Cooler
5000 to 3000 BP	Cool, moist conditions; vegetation zones depressed	5060 to 2760 BP	Initially moister condition followed by increased desiccation
6500 to 5000 BP	Pollen evidence indicates cooler and/or wetter conditions; however, geomorphic evidence suggests warm and moist conditions		
7500 to 6500 BP	Arid climate; vegetation zones slightly higher than present; warmer summer temperatures, reduced winter precipitation	8490 to 5060 BP	Drier and/or warmer; northward expansion of grasslands and northern forest limit
		9300 to 8490 BP	Gradual warming period; vegetation border moving northward and grasslands expanding eastward
10,000 to 7500 BP	Progressively warmer and drier		
		10,030 to 9300 BP	Gradual warming period
12,000 to 10,000 BP	Moderately cool and moist	Before 10,030 BP	Temperatures a few degrees cooler; gradual shift from boreal forests to grasslands indicating a drying and/or warming trend

[a] BP = years before present, with a present baseline of AD 1950.

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Table 2-5. A SUMMARY OF THE CULTURAL CHRONOLOGY OF THE AREA OF THE ROCKY MOUNTAIN ARSENAL

Cultural Unit					
Tradition	Period or Phase	Date[a]	General Settlement Patterns	General Subsistence Systems	Kinds of Archeological Remains Representative of Period
Historic	Ranching/ Farming	Post-AD 1910	Development of large farms and ranches, urbanization of Front Range and energy development	Irrigated farms and ranching with dispersed settlement, intense urbanization and population concentration in cities	Dominated by modern housing, regional transportation, and machines; complex urban remains
	Homestead/ Tourism	AD 1870 to 1910	Farming along major drainages and town/city development	Farming and development of regional transportation for economic movement of goods and services	Homestead and city architectureal unit, historic railroads
	Mining	AD 1858 to 1870	Small camps in foothills tied into larger economic life centered in developing towns along river routes	Mining is the dominant economic pursuit, which helped develop townsites along Front Range	Old mine areas and processing sites along with forts and towns
	Fur Trapping	AD 1800 to 1840	Individual trappers in mountains with trading forts along major drainages; Native American camps and short-term villages	Development of river traffic and sites for fur trading	European artifacts, trading forts along major rivers
	Exploration	AD 1770 to 1800	Exploratory expeditions of Spanish, French and American groups along major drainages; Native American camps and short-term villages	Hunting, gathering, trading	Short-term camping sites
Frontier	Ethnohistoric	AD 1550 to 1800	Sites are often campsites near sources of water and a variety of environmental habitats; small ridges and hillocks with views were preferred	Nomadic hunter/gatherers moved seasonally following bison herds; these bands changed from pedestrian hunter/gatherers to primarily horse nomad groups	Dismal River Aspect pottery and pithouses with a variety of lithic and bone tools associated with Plains Apache, Utes, Commanche, Cheyenne and Arapahoe entered the area after the Apache
Plains	Middle Ceramic	AD 1000 to 1550	Open campsite on the Plains and rockshelters and open sites in the Foothills indicate a nomadic hunting/gathering lifestyle; two cultural traditions may have occupied the study area contemporaneously	Hunting of both large and small animals combined with the gathering of wild plant foods; Plains occupation appears to be more intense than Foothills, and Plains sites are seasonally occupied camps for groups living permanently east of the study area	Small triangular projectile points, chipped stone tools, ground stone tools, and bone tools with distinctive varieties of cord-marked pottery and only a few shallow features

Table 2-5. A SUMMARY OF THE CULTURAL CHRONOLOGY OF THE AREA OF THE ROCKY MOUNTAIN ARSENAL (continued)

Cultural Unit					
Tradition	Period or Phase	Date[a]	General Settlement Patterns	General Subsistence Systems	Kinds of Archeological Remains Representative of Period
Plains Woodland	Early Ceramic Period	AD 1 to 1000	Campsites on south-facing knolls, open campsites and rockshelters near springs and secondary and tertiary drainages; nonlocally available grave goods possibly indicate long distance exchange network	Bands of generalized hunters and gatherers moved occasionally to exploit a variety of plants and animal resources; a foothills/plains dichotomy of settlement and subsistence activities may have occurred	Cord-marked ceramics with corner-notched projectile points, a variety of chipped stone tools, ground stone, and bone tools; some serrated side-notched projectile points; primary and secondary burials, with and without grave goods, numerous features in open sites and rockshelters
Plains Archaic	Late Archaic	3000 to 2000 BP	Hunting and gathering bands occupied campsites and rock-shelters in the foothills and plains; along the South Platte, sites occurred on high terraces and at minor tributary mouth locations	Generalized hunting and gathering subsistence focused on a variety of plants and animals, including aquatic species; possible greater reliance on plant resources than previously	Corner-notched projectile points with bifaces, unifaces, drills, ground stone (manos and metates), choppers, and bone tools; associated features and burials, pits, hearths, and rock-filled hearths
	Middle Archaic	5000 to 3000 BP	Both the foothills and Northeast Colorado Plains were inhabited; campsites occurred near water sources and in a variety of environmental habitats	Focus on the killing and processing of large and small animals, and a variety of wild plants were gathered; seasonal movement of the bands insured that a variety of protein sources were used	Projectile points are of the McKean-Duncan-Hanna and Mount Albion series; knives, unifaces, drills, utilized flakes, hammerstones, ground stone and bone tools; associated cists and rock-lined hearths
	Early Archaic	7000 to 5000 BP	Open campsites or rock-shelters are the principal site types found in the Front Range Foothills; sites are located near reliable water sources and near several micro-habitats	Hunting and gathering bands moved seasonally to higher elevations in the spring and summer and down to the foothills during the fall and winter; a variety of plants and small and medium sized animals and plants were eaten	Mount Albion Complex points, knives, scrapers, perforators, gauges, gravers, cores, microtools, grinding slabs, handstones, and rock filled hearths
Paleo-Indian	Plano	10,000 to 7,500 BP	Kill sites, butchering stations, long- and short-term campsites	Mass killing by stampeding bison into natural traps is the major theme; seasonal hunting and gathering of other food items is inferred	Parallel-flaked projectile points associated with lithic cutting and scraping tools and bone tools

Table 2-5. A SUMMARY OF THE CULTURAL CHRONOLOGY OF THE AREA OF THE ROCKY MOUNTAIN ARSENAL (concluded)

Cultural Unit					
Tradition	Period or Phase	Date[a]	General Settlement Patterns	General Subsistence Systems	Kinds of Archeological Remains Representative of Period
	Folsom	11,000 to 10,000 BP	Sites near permanent water sources and on hilltops with strategic views	Primary activity is the hunting of bison (Bison antiquus), supplemented by seasonal exploitation of available plants and smaller animals	Folsom points with lithic flakes, blades, drills, burins, bifaces, unifaces, choppers, ground stone and bone tools
	Clovis	12,000 to 11,000 BP	Sites near permanent water sources (stream-side, springs, lakes)	Primary activity is the hunting of Pleistocene megafauna, such as mammoth, horse, and camel, as well as the seasonal exploitation of vegetal products and small animals	Clovis points with scrapers, retouched flakes, core choppers, and bone expediency tools
	Selby-Dutton	15,000 to 11,500 BP	Kill sites near permanent water sources such as springs, streams, or lakes	Primary activity is the hunting of mammoth, as well as the seasonal exploitation of vegetal products and small animals	Spiral-fractured mammoth bone expediency tools, bone flakes, and bone cores with very small lithic flakes

[a] BP = years before present, with a present baseline of AD 1950.

about the Plains "abandonment" for a refuge in the higher elevation of the nearby foothills of the Rocky Mountains.

The Plains Archaic tradition is divided into three chronological periods: Early, Middle, and Late. Early Archaic is dated from 7500 to 5000 BP, and is concurrent with the onset of the Altithermal.

During the Middle Archaic period (from 5000 to 3000 BP), the Front Range Foothills and east central Colorado Plains were occupied by gathering and hunting bands equipped with McKean Complex (Jennings 1974, Mulloy 1954) tool assemblages. East of th Foothills and along the South Platte drainage, Middle Archaic sites are much more prevalent than are Early Archaic materials.

Subsistence activities focused on the killing and processing of large and small mammals and some gathering of wild plant seeds (goosefoot), acorn, wild plum, sedges, and chenopods.

The Late Archaic period in the Foothills and South Platte areas lasted from 3000 until 2000 years ago (or AD 1). The generalized hunters and gatherers of the Late Archaic exploited a great variety of wildlife, including bones of large mammals (bison, mule deer, pronghorn), smaller animals (bobcat, fox, rabbit, vole, rodents), birds, snakes, and fish.

Subsistence activities of the Late Archaic are similar to the Early and Middle Archaic, though Greiser (1980) considers that from Early Archaic onward subsistence changed to include a greater reliance upon plant resources. This subsistence shift is reflected in the archeological remains at Middle and Late Archaic sites, where during the Middle Archaic a greater emphasis on plant food resources (gathering and processing) is indicated by the presence of storage pits, roasting pits, stone-filled hearths and grinding stones. Settlement patterns during the Late Archaic were similar to the Middle Archaic. Kvamme (1979) found that along the South Platte, Archaic sites regularly occurred on high terraces parallel to the river and at minor tributary mouth locations.

The Plains Woodland tradition dates between AD 1 and 1000. In the Front Range Foothills and the Northeast Colorado Plains, prehistoric populations continued to live as hunting and gathering bands. However, technological changes occurred in the group's toolkit and a special burial pattern characterizes the Woodland adaptation in these areas of Colorado. Ceramics appear in Woodland contexts and represent a significant cultural/technological innovation. Another significant cultural aspect of the Plains Woodland populations is the Colorado Plains Woodland Mortuary Complex (Breternitz and Wood 1965; Scott 1979; Scott and Birkedal 1972), whose characteristics may indicate long distance regional contacts with other Woodland groups to the east of Colorado.

The Northeast Colorado Plains area contains many Plains Woodland (also known as Early Ceramic) period sites. Limited site surveys have

produced evidence of at least 20 other "Woodland" components in the area (Colorado Preservation Office 1983), their materials implying a nomadic hunting and gathering economy based on a wide range of small game and a smaller range of large mammals (notably bison, pronghorn, and elk), and sunflower, waxcurrant brush, wild grape, and yucca. Open camps and rockshelters were the site types, and no habitation structures have been excavated. Artifacts other than the diagnostic projectile points and cord-impressed pottery mentioned above are bifaces, unifaces, drills, retouched flakes, hammerstones, ground stone (manos and metates), and bone and antler tools. Perishables include arrowshafts and yucca fiber rope. Campsites generally are not located on major drainages but near springs, and secondary and tertiary drainages. Rockshelter sites often occupy a south-facing outcrop (Scott 1979).

The Middle Ceramic period (AD 1000 to 1550) appears to represent a less intense occupation of the northeastern Colorado Plains. This is an extension of the hunting and gathering activities seen in earlier periods. Bison, with elk, pronghorn, grizzly bear, mule deer, rabbit, prairie dog, pocket gopher, and bird remains have been found in these sites, and it has been postulated (W. R. Wood 1971) that the Middle Ceramic Period sites in the northeastern Colorado Plains are hunting locations used by Upper Republican Indians who lived east of the area. However, Irwin and Irwin (1957) have described the inhabitants of Northeast Colorado during the Middle Ceramic as indigenous, sedentary groups with some characteristics of a hunting and gathering adaptation.

2.2.2 Ethnohistory

During the Ethnohistoric period (AD 1550-1880), the eastern Colorado Plains and Foothills were inhabited by several nomadic bison-hunting Plains Indian groups. These groups generally moved southward due to conflict and population pressure from the north and east. At the time of the Spanish entry to North America, the Plains Apache occupied the Colorado Plains. Historical references place the Plains Apache in eastern Colorado in either the early 1640s (Forbes 1960) or the late 1660s (Thomas 1935). These Athabascan speakers were actually many groups, most of which have been described as the Lipan and Jicarilla Apache (Buckles 1968). The Dismal River Aspect, dated approximately AD 1675-1725, is a Central Plains archeological complex that represents the Plains Apache groups (Gunnerson 1968). The Plains Apache were pushed south by intrusions of the Utes and Commanches during the early 1700s. These two Shoshonean-speaking groups quickly spread onto the Colorado Plains in place of the departing Plains Apache. By 1750 the Utes and Commanches split, with the Commanche occupying most of the Colorado Plains. In 50 years, the Commanche moved southward until they occupied only the Plains area south of the Arkansas River. The Cheyenne and Arapaho inhabited the plains north of the Arkansas River by the early 1800s. Both the Cheyenne and Arapahoe are Algonkian-speakers who originally came from woodland areas north and east of the Colorado Plains. The Cheyenne left their permanent villages and horticultural subsistence base to become famous horse nomads (Strong 1940), and archeological remains of these people in the area of the Rocky Mountain Arsenal is expected to be only ephemeral.

2.2.3 History

The history of the Colorado Front Range and Plains can be grouped into five themes: (1) exploration, (2) fur trapping, (3) mining, (4) homestead/tourism, and (5) ranching/farming.

Initial exploration of the general area by Anglo groups occurred after 1776 when Spaniards from Mexico infrequently traveled through Colorado. Later, in 1806, fur trappers Zebulon Pike and James Purcell explored the Arkansas River area. Zebulon Pike described Pike's Peak but he did not actually climb its summit. In 1820, Major Stephen Long led 19 men along the Rocky Mountain Front Range, visiting the present sites of Greeley, Denver, and Colorado Springs. Members of this exploratory expedition first climbed Pike's Peak.

The fur trapping period (ca. 1800-1840) was a time when river routes were developed for economic transportation. Animal furs were the primary regional economic product since there was a strong European market for these items. Front Range drainages, especially the South Platte and Cherry Creek, became major fur transportation lanes. It was natural for trading centers to develop along the major river drainages, and along the South Platte River, trading posts such as Fort Vasquez, Fort Lookout, Fort George and Fort St. Vrain were built by 1837. The furs went from these centers to St. Louis, using the Santa Fe Trail. European demand for fur tapered off in the middle 1840s and the fur trade quickly declined. Gold fever soon replaced the fur trade as an economic lifestyle in Colorado, and the gold seekers used many of the same trails as the fur trappers.

The mining theme dominated Colorado history from 1858 on, after William Green Russel and a group of gold seekers found gold at the confluence of Cherry Creek and the South Platte River. The Arkansas River drainage was used for travel to Pueblo, and from Pueblo gold seekers followed Fountain Creek to Colorado Springs. Pike's Peak was a symbol of the gold rush, but mining in the Denver and Pike's Peak region was relatively unsuccessful and short-lived (Ubbelohde, Benson, and Smith 1972: 199-201).

The fourth theme in Colorado Foothills and Plains history is homestead/railroads/tourism. The Homestead Act of 1862 formally began this theme, as many unsuccessful gold seekers decided to settle and farm in the region. Permanent rivers, including the Arkansas and South Platte, were the initial focus of farming. Railroads (Denver Pacific; Denver and Rio Grande) made transportation easier and facilitated the mining, ranching, and homesteading activities in Colorado. The railroads also brought in tourists to the developing areas. The introduction of truck freighting was the demise of historical railroads (Ubbelohde, Benson, and Smith 1972:199,234) in the late 1910s.

Ranching and farming became dominant activities after 1910 as people began to permanently settle and develop the area. Dry climatic cycles caused some abandonment of ranches and farms, but the introduction of

irrigation insured successful and productive farming. During this century, the Denver area became a large urban area specializing in regional energy development, exchange of economic products, and administration activities.

The history of the immediate arsenal vicinity and pre-facility land use patterns will be further discussed in the companion historic properties study in preparation by NPS's Historic American Building Survey (HABS) (William Brenner, personal communication 1984).

2.3 ARCHEOLOGICAL RESEARCH DIRECTIONS

The comprehensive state preservation plan modeled after the National Park Service's Resource Protection Planning Process (RP3) for the Eastern Colorado Plains has not been completed in final form (Butler 1982; Colorado Preservation Office 1983 [Eighmy (1984) was not available until this report went into final reproduction]). Significant archeological and historic preservation problems identified in this draft document are followed, but since the document is not finished, not all of the potential problems can be covered here. In the following discussion, the significant archeological research directions are identified in each cultural period.

The nature and extent of cultural materials of the Selby-Dutton Period, with its postulated bone tool technology, must be examined. This period represents the initial occupation of the Great Plains and as such is an important and controversial research topic. The Selby-Dutton Period and other periods of the Paleo-Indian Tradition should be studied in light of adaptations to the environment. Archeologists continue to seek to identify the range of the subsistence adaptations focusing on Pleistocene megafauna during the Paleo-Indian Tradition. Strong archeological interest remains in determining the technology used to make the stone tools of the Clovis, Folsom, and Plano periods.

In the Early Archaic Period, important questions revolve around the impact of the postulated Altithermal climate on Plains and Front Range Foothills prehistoric groups. Early Archaic sites on the Plains are rare and their study can provide estimates of population intensity and adaptation to the Plains environment, including evidence of seasonality and site functions. In addition, sediments from Early Archaic sites need to be studied for evidence of paleoclimatic conditions during this time. Stratigraphic correlation of sediments with Early Archaic sites in both the Foothills and Plains must be attempted so that the chronological placement of acceramic sites lacking other means of dating can be estimated.

During the Middle and Late Archaic Periods, both the Front Range Foothills and Northeastern Colorado Plains were occupied by hunting and gathering bands. These bands moved seasonally to use effectively the animal and plant resources available at different places at different

times of the year. Archeological research dealing with Middle and Late Archaic sites concentrates on several topics. Diagnostic stone tool technologies and designs to evaluate their relationships with other regional lithic production systems need to be carefully studied. The analyses of subsistence items found in site deposits and tool functional analyses, when coupled with chronological determinations, can trace temporal shifts in subsistence adaptations. The hypothesis that Middle and Late Archaic bands relied more heavily on wild plant resources, when compared to Early Archaic bands, requires testing with archeological field data. Site settlement analysis can help test the above hypothesis by examining the relationship of Archaic site locations with landforms and locally available environmental resources.

Archeological research concerning Early Ceramic materials should follow three major topics: climatic reconstruction, introduction of pottery, and burial activities. The Early Ceramic period is marked by moderate temperatures and increasing effective moisture and consequent increased runoff and erosion. Excavations of Early Ceramic sites should make efforts to date and stratigraphically record the period depositional record. The archeological question of the geographical origins of the newly-introduced pottery needs attention. Research on this question must face again the postulated seasonality of Front Range groups. The Colorado Plains Mortuary Complex (Bretemitz and Wood 1965) is unique to the Early Ceramic period. The relationship of this cultural system of burials and associated burial goods with major prehistoric cultures east of the Colorado needs evaluation. It is possible that the Colorado Plains was involved in a long distance exchange network which provided the materials (ocean shell) for the burial complex.

Middle Ceramic period archeological research continues to focus on description and analysis of the subsistence and settlement patterns. Were these groups indigenous people who lived there permanently as marginal horticulturalists? Or, were these groups nomadic hunters taking advantage of the bison resources of the Northeast Colorado Plains, and then returning east to their permanent homes? Key questions about Middle Ceramic period sites concern their season of use and their function. The other major research topic for Middle Ceramic materials concerns the possibility of another cultural group (Shoshonean) living in the foothills and producing Intermountain Ware. The technology, dating, and possible cultural affiliation of this type of pottery must be investigated.

In the Ethnohistoric Period several research questions exist. The archeological record contains evidence for the cultural and technological transformation of horticultural groups into horse nomads. This record of culture change for the Dismal River Aspect remains untapped. Archeologists need to identify, to the tribal level, the various cultural groups living in Colorado during the Ethnohistoric Period.

Several research questions are associated with the Historic Tradition. During the Exploration Period, the nature and intensity of the

culture contact situation should be examined. If the appropriate records can be located, it may be possible to identify the named Native American tribes living in the nearby area. In the Exploration, Fur Trapping, and Mining periods, important questions remain unanswered concerning the trade of cultural and economic items between different cultural groups. Additional research questions also exist for the basic man-land relationships through time. Technological changes were rapid and the archeological resources should illustrate these changes that are not well described in the historic archival records. In addition, dramatic climatic shifts occurred during this time, providing a backdrop for investigating cultural adaptations to changing environmental conditions. Rocky Mountain Arsenal personnal should also consult the Colorado SHPO for current RP3 prehistoric and historic theme studies that may be applicable to their facility.

3.0

AN ASSESSMENT OF ARCHEOLOGICAL RESOURCE PRESERVATION AND SURVEY ADEQUACY

3.1 ENVIRONMENTAL CONSTRAINTS TO SITE PRESERVATION

Cycles of deposition and erosion can protect and then remove all or portions of archeological resources. It is important to recognize locations where archeological resources can be found in protected deposits that have not been eroded. This section isolates the environmental factors affecting the preservation of archeological resources on the Rocky Mountain Arsenal.

As stated earlier (Section 2.1.1), the physiographic structure of the Rocky Mountain Arsenal resulted from geomorphic processes beginning in the Late Cretaceous and extending into the Quarternary (see also Scott 1982). Bedrock surface topography (Konikow 1975) and drainage patterns in the Denver Formation were formed during downcutting that began in the early Pliocene. Downcutting during the Quarternary has been interrupted many times when the major drainage baselevel was stabilized long enough for deposition to occur. The depositional episodes left the Verdos Alluvium, Slocum Alluvium, Broadway Alluvium and the Piney Creek and Post-Piney Creek Alluvium in the valleys of the major drainages (Scott 1982). There is no Broadway Alluvium on the arsenal property and the other Pleistocene alluvial deposits (Verdos and Slocum Alluvium) are located near the First Creek drainage (Trimble and Machette 1979). Away from the drainage Upper Pleistocene loess and windblown sand cover the alluvial deposits.

Given these geomorphic parameters, we expect no archeological sites with covered materials and physical integrity where the Denver Formation bedrock is exposed at Rocky Mountain Arsenal (Section 2.1.1). If sites are located here, they will be surface sites only. The Verdos Alluvium and Slocum Alluvium are Pleistocene deposits which antedate the appearance of human groups in North America. Any archeological site found in these deposits cannot have integrity. Sites found in the Upper Pleistocene loess suffer the same problems as the Verdos and Slocum Alluvium.

Quaternary deposits which have the highest probability of containing archeological sites with integrity are the windblown sand deposits, the Piney Creek, and Post-Piney Creek alluvial deposits. The Late Pleistocene (Early Holocene) eolian sand could cover sites associated with Broadway Alluvium; Paleo-Indian sites can be found in Broadway deposits. The

Piney Creek Alluvium is typically associated with Plains Archaic sites, and Post-Piney Creek Alluvium is associated with Plains Woodland and Plains Village materials. Archeological sites in these alluvial deposits will be protected as long as later erosional cycles have not cut into the archeological sites.

3.2 HISTORIC AND RECENT LAND USE PATTERNS

Local surface and subsurface ground disturbance intensified when the Rocky Mountain Arsenal began operations in 1942. Before that time, scattered farming houses and fields impacted archeological resources in the area. Rocky Mountain Arsenal activities have impacted approximately 52 percent of the ground surface within the boundaries of the arsenal (Figure 3-1). A total of 8952 acres of the arsenal's 17,152 acres have been disturbed by activities in 31 separate disturbance activity locations (Table 3-1). These activities vary in their depth of disturbance and the percentage of total surface area disturbed. In addition to the ground disturbance activities shown in Figure 3-1 and listed in Table 3-1, unimproved roads follow every section line within the arsenal, and the outside boundaries are lined (on the inside of the boundary fence) by a firebreak. The small lakes south of the South Plant are linked to a series of canals that enter the arsenal from the south. The intensity of disturbance associated with these canals is not known but it could be significant; the rusting remains of a large crane were observed in one canal.

No archeological excavations or vandalism have impacted the surface of the Rocky Mountain Arsenal. Some areas of the arsenal may be more subject to wind and water erosion since ground water contamination has killed or severely affected the natural ground cover. Where the ground surface is disturbed (such as the quarry in section 19), natural erosional forces can quickly destroy the integrity of any archeological sites that may remain there because the surface deposits are relatively thin. Water erosion occurs in First Creek and its drainages on the arsenal. Archeological resources located near this drainage system are subject to these erosional forces. Animal disturbance is becoming a severe problem. Prairie dog (Cynomys ludovicianus) colonies are well established in sections 5, 29, 28, 30 and 32 of the arsenal and the colonies are expanding into other portions of the arsenal.

3.3 PREVIOUS CULTURAL RESOURCE INVESTIGATIONS: COVERAGE AND INTENSITY

There have been no previous cultural resource investigations on the Rocky Mountain Arsenal. However, many environmental studies have been made. Three studies summarize the existing data on surface and subsurface water flow characteristics (hydrogeology), wildlife populations, and aquatic community studies within the arsenal boundaries (Table 3-2). These studies are the most directly useful to cultural resource management concerns, when compared to the hundreds of very small scale and detailed environmental studies undertaken at the Rocky Mountain Arsenal.

Table 3-1. A SUMMARY OF HISTORIC AND MODERN GROUND DISTURBANCE THAT MIGHT LIMIT THE PRESENT ARCHEOLOGICAL RESOURCE BASE ON THE ROCKY MOUNTAIN ARSENAL (concluded)

GDA No.[a]	Type of Disturbance	Date Conducted (yr)	Reference	Area Disturbed (acres)	Estimated Depth Below Surface (ft)	Ratio of Disturbed to Total Area	Location of Disturbed Area						
							UTM[b]		Legal Reference[c]			USGS Quad Sheet[d]	Coincidental Sites[e]
							Northing	Easting	Township	Range	Section		
29	Munitions test area with fireheads, rocket test area, storage area for containers, and caustic holding basin; also roads, sewers, drainages, and canals have been constructed and maintained	1948, pre-952, and pre-1948	Rocky Mtn. Arsenal (1982)	362	3-4	4:10	4410020 4410020 4409120 4409120	511420 512750 512750 511420	T2S	R67W	35, 34	S76579	NA
30	Construction of rock quarry	Pre-1982		6	7-10	9:10	4413140 4413140 4413000 4413000	515100 515280 515280 515100	T2S	R66W	19	S76579	NA
31	Construction of a water purification plant	Pre-1982		6	3-5	8:10	412320 412320 412100 412100	513040 513150 513150 513040	T2S	R67W	23	S76579	NA

[a] Ground Disturbance Areas (GDAs) as mapped in Figure 3-1.

[b] UTM = Universal Transverse Mercator coordinates, Zone 12. If the area is less than 10 acres in extent, the coordinates record the approximate center of the site. If it is larger, they record the corners of a 3-or-more sided figure that encloses the site. Such corner designations are listed in a clockwise sequence beginning with the northwest corner (e.g., NW, NE, SE, SW). Coordinates have been calculated specifically for this study.

[c] If area lies in two sections, then the section which accounts for most of the area is listed first.

[d] S76579 = Sable, CO, 7.5 min. sheet, (1965), photorevised 1979); CC76580 = Commerce City, CO, 7.5 min. sheet (1965, photorevised 1980).

[e] NA = not applicable.

Table 3-1. A SUMMARY OF HISTORIC AND MODERN GROUND DISTURBANCE THAT MIGHT LIMIT THE PRESENT ARCHEOLOGICAL RESOURCE BASE ON THE ROCKY MOUNTAIN ARSENAL

GDA No.[a]	Type of Disturbance	Date Conducted (yr)	Reference	Area Disturbed (acres)	Estimated Depth Below Surface (ft)	Ratio of Disturbed to Total Area	Location of Disturbed Area						
							UTM[b]		Legal Reference[c]			USGS Quad Sheet[d]	Coincidental Sites[e]
							Northing	Easting	Township	Range	Section		
1	Construction of buildings, warehouses, power plants, storage tanks, and railroad tracks	Post-1942	Rocky Mtn. Arsenal (1978)	631	5-10	7:10	4408400 4408400 440780 4407840	511540 514760 514760 511530	T3S and T2S	R67W R67W	1, 2 36, 35	S76579	NA
2	Construction of storage warehouse, storage bunkers, railroad tracks, and toxin gas yard	1940s to pre-	Rocky Mtn. Arsenal (1982)	1,231	3-6	2.5:10	4410030 4410030 4406780 4406770	514770 516330 516340 514750	T2S and T3S	R66W R66W	31 6	S76579	NA
3	Enlarging four lakes and modifying lakes by raising and strengthening dikes; lakes have been drained and scraped to remove contaminants	Post-1942; 1964	Rocky Mtn. Arsenal (1982)	721	.5-3	5:10	4407840 4407780 4406770 4406810	511800 514750 514750 511510	T3S	R67W	1, 2	S76579	NA
4	Construction of warehouse storage buildings, an oil pump house, and automotive storage garages and repair shops and trash pits, and railroad tracks	1950 to 1973	Rocky Mtn. Arsenal (1982)	600	5	5:10	4408370 4408380 4406800 4406800	509040 5510420 510420 509030	T3S T3S	R67W	4, 3	CC76580	NA
5	Construction of liquid petroleum storage facility, fuel storage tanks, and railroad tracks	1940s onward	Rocky Mtn. Arsenal (1982)	65	3	9:10	4409320 4409320 4408400	514540 514760 514760	T2S	R67W	36	S76579	NA

Table 3-1. A SUMMARY OF HISTORIC AND MODERN GROUND DISTURBANCE THAT MIGHT LIMIT THE PRESENT ARCHEOLOGICAL RESOURCE BASE ON THE ROCKY MOUNTAIN ARSENAL (continued)

GDA No.[a]	Type of Disturbance	Date Conducted (yr)	Reference	Area Disturbed (acres)	Estimated Depth Below Surface (ft)	Ratio of Disturbed to Total Area	Location of Disturbed Area						
							UTM[b]		Legal Reference[c]			USGS Quad Sheet[d]	Coincidental Sites[e]
							Northing	Easting	Township	Range	Section		
6	Construction of five waste basins, trash pits, incendiary burial and testing areas, burning sites, chemical burial/disposal pits, chemical and sanitary sewers, a deep disposal well, and a fire station	Late 1940s onward	Rocky Mtn. Arsenal (1982)	1,522	6-10	8:10	4411620 4411620 4408400 4408400	511400 513150 514530 513140	T2S	R67W	23, 36, 35,27	S76579	NA
7	Construction of bachelor officers quarters and troop housing units	Post-1942	James Bucholtz, personal communication (1983)	21	3-5	8:10	4408760 4408760 4408400 4408400	511200 514480 511320 511200	T2S	R67W	34	S76579	NA
8	Construction of non-commissioned officers family housing	Pre- and post-1942	James Bucholtz, personal communication (1983)	4	3-5	8:10	4408760 4408760 4408580 4408580	511590 511700 511700 511590	T2S	R67W	35	S76579	NA
9	Construction of arsenal headquarters, communication buildings roadway	Post-1942	Rocky Mtn. Arsenal (1978)	4	3-5	8:10	4408700 4408700 4408400 4408400	512000 512340 512340 512000	T2S	R67W	35	S76579	NA
10	Construction of arsenal entrance administration and security building and parking lot	Post-1942	Rocky Mtn. Arsenal (1978)	25	3-5	8:10	4408520 4408520 4408200 4408200	508320 508600 508600 508320	T3S and T2S	R67W R67W	4 33	CC76580	NA

Table 3-1. A SUMMARY OF HISTORIC AND MODERN GROUND DISTURBANCE THAT MIGHT LIMIT THE PRESENT ARCHEOLOGICAL RESOURCE BASE ON THE ROCKY MOUNTAIN ARSENAL (continued)

GDA No.[a]	Type of Disturbance	Date Conducted (yr)	Reference	Area Disturbed (acres)	Estimated Depth Below Surface (ft)	Ratio of Disturbed to Total Area	Location of Disturbed Area						
							UTM[b]		Legal Reference[c]			USGS Quad Sheet[d]	Coincidental Sites[e]
							Northing	Easting	Township	Range	Section		
11	Construction of tennis courts and playing field	Post-1942	Rocky Mtn. Arsenal (1978)	29	1-2	4:10	4408760	511480	T2S	R67W	35, 34	S76579	NA
12	Construction of recreational area with swimming pool and buildings, cafeteria and residence with garage	Post-1942	Rocky Mtn. Arsenal (1978)	16	6-10	2:10	4407840 4407840 4407580 4407580	511530 511780 511780 511520	T3S	R67W	2	S76579	NA
13	Construction of railroad tracks, weapons plants, storage vaults, decontamination rooms, cafeteria, fuse detonation magazines, and warehouses	Post-1942 to early 1970s	Rocky Mtn. Arsenal (1982)	420	6-8	6:10	4411620 4411620 4410030	513620 514550 514550	T2S	R67W	25, 36	S76579	NA
14	Construction of a warehouse and roads, trenches, sanitary landfill and an impact site for bombs, a burn site and a demil site	Post-1958 to early 1970s	Rocky Mtn. Arsenal (1982)	380	2-3	4·10	441180 4411180 4410030 4410030	515540 516320 516330 514770	T2S	R66W	30, 29	S76579	NA
15	Burn sites for incendiary bombs, TX production sites, disposal for rocket motors and weapons	Post-1958	Rocky Mtn. Arsenal (1982)	664	3-4	5:10	4412470 4412190 4410040 4410030	515350 517480 517100 516330	T2S	R66W	29, 19, 20, 30	S76579	NA

Table 3-1. A SUMMARY OF HISTORIC AND MODERN GROUND DISTURBANCE THAT MIGHT LIMIT THE PRESENT ARCHEOLOGICAL RESOURCE BASE ON THE ROCKY MOUNTAIN ARSENAL (continued)

GDA No.[a]	Type of Disturbance	Date Conducted (yr)	Reference	Area Disturbed (acres)	Estimated Depth Below Surface (ft)	Ratio of Disturbed to Total Area	Location of Disturbed Area						
							UTM[b]		Legal Reference[c]			USGS Quad Sheet[d]	Coincidental Sites[e]
							Northing	Easting	Township	Range	Section		
16	Construction of incendiary bomb storage sheds, burning pits, bomb disposal area, phosgine storage area; sheds have been removed	1940s to 1970s	Rocky Mtn. Arsenal (1982)	1,314	3-4	5:10	4410030 4410040 4405180 4405180	516330 517400 517100 515520	T2S and T3S	R66W R66W	32 8, 7, 5	S87580	NA
17	Construction of a rifle with two berms, a club building, picnic area, and a residence	Post-1940s	Rocky Mtn. Arsenal (1978)	118	1-3	2:10	4406500 4406800 4405960 4406180	512550 513570 513560 512610	T3S	R67W	12, 11	S76579	NA
18	Construction of picnic area	Post-1940s	Rocky Mtn. Arsenal (1978)	3	.5-1	2:10	4405700 4405700 4405550 4405550	513020 513130 513130 513020	T3S	R67W	11	S76579	NA
19	Construction of a picnic area AMSA/OMS maintainance building	Post-1940s to 1983	Rocky Mtn. Arsenal (1978); James Bucholtz, personal communication 1983	29	3-4	5:10	4405480 4405480 4405180	513120 513300 513300	T3S	R67W	11, 12	S76579	NA
20	Construction of U.S. Post Office building and a weapons disposal area	Post-1094s to 1971	Rocky Mtn. Arsenal (1982)	230	5-8	7:10	4405900 4405900 4405190 4405190	508310 509470 509470 508310	T3S	R67W	9	CC76580	NA
21	Construction of a water treatment plant, numerous wells, and filter tanks	Late 1970s	Rocky Mtn. Arsenal (1978)	83	5 (wells much deeper)	4:10	4410140 4409920 4409260 4409480	509300 509540 508940 508700	T2S	R67W	33, 28	CC76580	NA

Table 3-1. A SUMMARY OF HISTORIC AND MODERN GROUND DISTURBANCE THAT MIGHT LIMIT THE PRESENT ARCHEOLOGICAL RESOURCE BASE ON THE ROCKY MOUNTAIN ARSENAL (continued)

GDA No.[a]	Type of Disturbance	Date Conducted (yr)	Reference	Area Disturbed (acres)	Estimated Depth Below Surface (ft)	Ratio of Disturbed to Total Area	Location of Disturbed Area: UTM[b] Northing	UTM[b] Easting	Legal Reference[c] Township	Range	Section	USGS Quad Sheet[d]	Coincidental Sites[e]
22	Construction of an industrial waste treatment plant, numerous wells, and filter tanks	Late 1970s	Rocky Mtn. Arsenal (1978)	287	3 (wells much deeper	4:10	413220 413220 412470 412740	512360 514410 514410 512360	T2S	R67W	24, 23	S76579	NA
23	Construction of antennas and associated building	Post-1940s	Rocky Mtn. Arsenal (1978)	23	2-3	2:10	4411980 4411980 4411620	513150 513570 513570	T2S	R67W	24	S76579	NA
24	Construction of a pistol range, two berms, and a small house	Post-1940s	Rocky Mtn. Arsenal (1978)	6	2-3	8:10	4412540 4412540 4412360 4412360	515100 515280 515280 515100	T2S	R66W	19	S76579	NA
25	Construction of residential housing, roadway and landscaping	Post-1940s	Rocky Mtn. Arsenal (1978)	46	5-6	4:10	4407620 4407620 4407320	510920 511520 511520	T3S	R67W	3	S76579	NA
26	Unknown excavation and/or mound	Pre-1949	Rocky Mtn. Arsenal (1982)	12	3(?)	9:10(?)	4406650 4406650 4406520 4406520	509100 509340 509340 509100	T3S	R67W	9	CC76580	NA
27	Disturbed area, history unknown	Pre-1976	Rocky Mtn. Arsenal (1982)	6	3(?)	9:10(?)	4405800 4405800 4405660 4405660	512380 512520 512520 512380	T3S	R67W	11	S76579	NA
28	Buried lake sludge	Post-1964	Rocky Mtn. Arsenal (1982)	46	5-6(?)	9:10(?)	4406800 4406800 4406500 4406500	512420 513000 513000 512420	T3S	R67W	11	S76579	NA

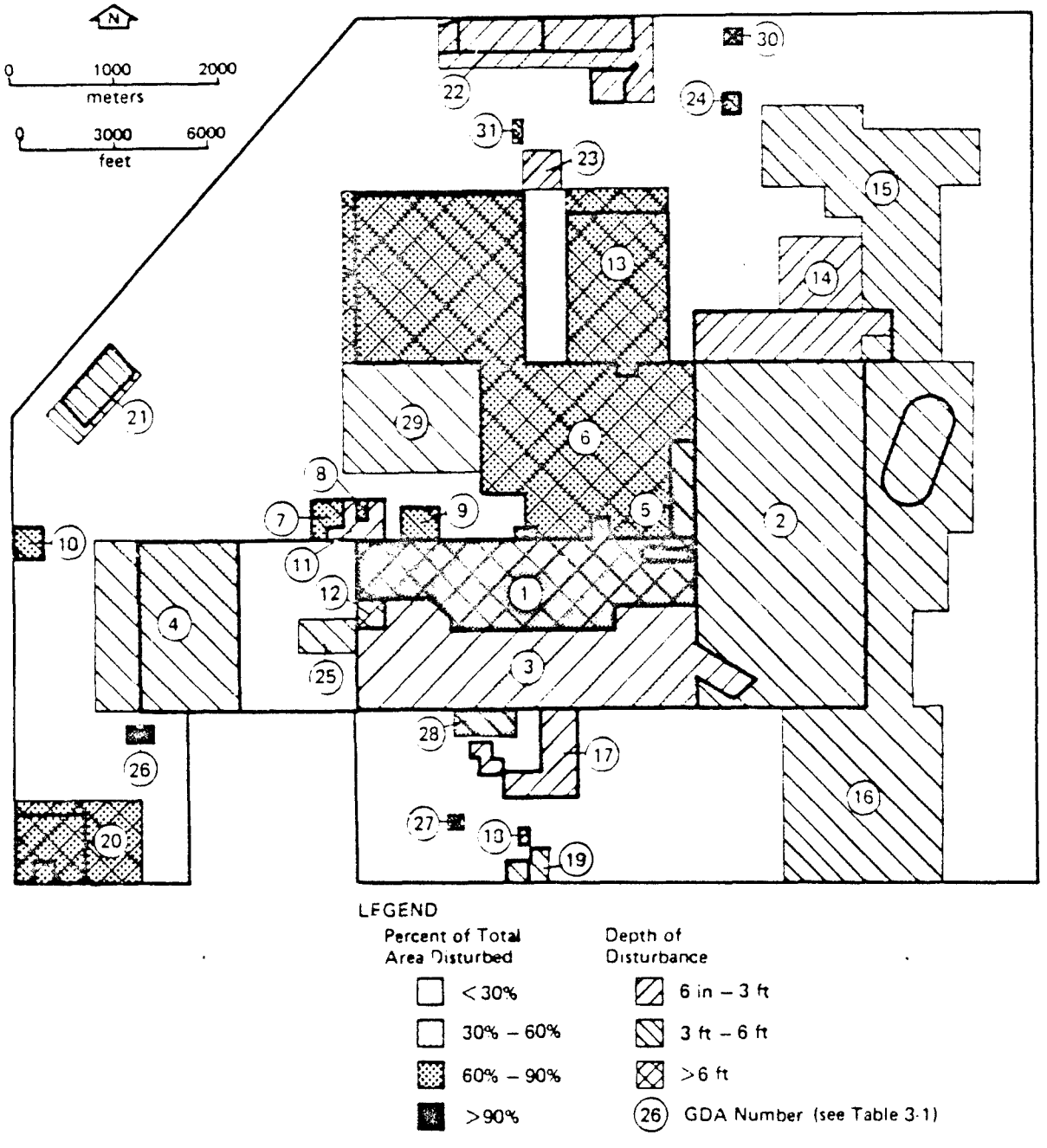

Figure 3-1. MAP OF AREAS OF HISTORIC AND/OR MODERN GROUND DISTURBANCE THAT MIGHT LIMIT THE PRESENT ARCHEOLOGICAL RESOURCE BASE ON THE ROCKY MOUNTAIN ARSENAL

The hydrogeology and general environmental assessment studies cover all the arsenal's property. In contrast, the aquatic community ecological study sampled Lake Mary, Lake Ladora, Upper and Lower Derby Lakes, the North Bog, the Rod and Gun Club Pond, the First Creek (Figure 3-2).

3.4 SUMMARY ASSESSMENT OF DATA ADEQUACY, GAPS

Cultural resources could occur on the Rocky Mountain Arsenal in those areas which have not been subject to ground disturbance activity (see Figure 3-1). Since no cultural resource surveys have occurred at the Rocky Mountain Arsenal, it follows that all the cultural resources within the arsenal's boundaries have not been identified and recorded. There are several landforms which could contain cultural resources and which have not been affected by ground disturbance activities. Areas with the best likelihood for containing cultural resources with integrity include hillocks and terraces along the First Creek drainage, and isolated hillocks. Rocky Mountain Arsenal personnel are encouraged to develop close coordination on future project development with the Colorado SHPO.

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Table 3-2. ARCHEOLOGICALLY RELEVANT RESEARCH INVESTIGATIONS, EXCLUSIVE OF ARCHEOLOGICAL SURVEYS, CONDUCTED ON THE ROCKY MOUNTAIN ARSENAL

Study No.	Study Type	Study Date	Institution, Agency, Firm	Principal Investigator[a]	Bibliographic Reference	Location					USGS Quad Map[c]	Associated Archeological Resources
						UTM		Legal				
						Northing	Easting	Township	Range	Section		
1	Hydrogeology	1975	United States Geological Survey	Konikow	Konikow 1975	Entire Facility					S76579 C76580	5AM185
2	Ecological Assessment	1975-1980	Arthur D. Little Inc.	Un	Campbell 1980	Entire Facility					S76579 C76580	5AM185
3	Aquatic Community Ecological Studies	1977	Rocky Mountain Fisheries Consultants, Inc.	Un	Campbell 1980	Parts of Facility[b]					S76579	

[a] Unknown (Un)

[b] See Figure 3-2 for locations

[c] S76579 = Sable, CO, 7.5 min. sheet (1965, photorevised 1979);
C76580 = Commerce City, CO, 7.5 min. sheet (1965, photorevised 1980)

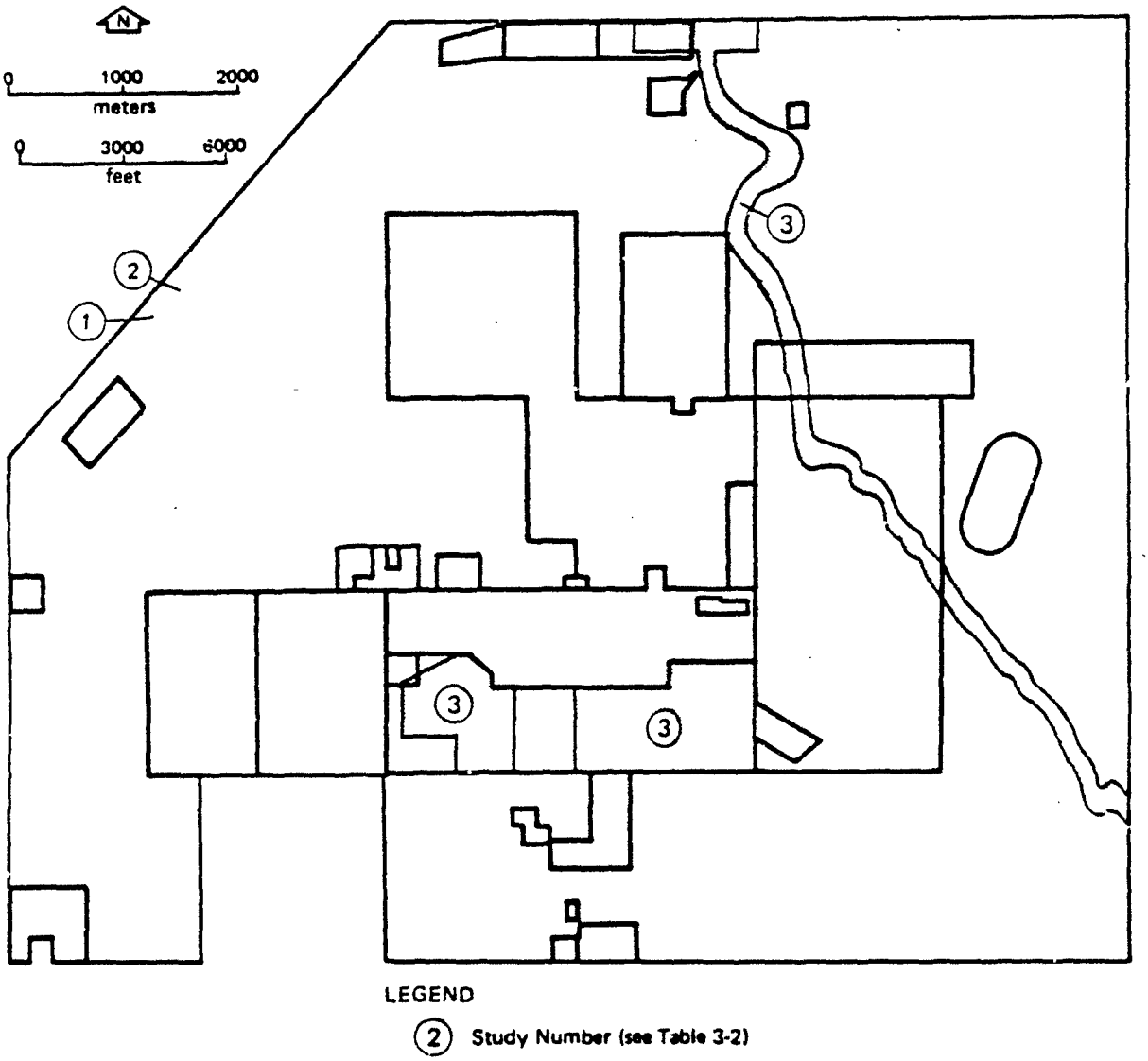

Figure 3-2. ARCHEOLOGICALLY RELEVANT RESEARCH INVESTIGATIONS, EXCLUSIVE OF ARCHEOLOGICAL SURVEYS, CONDUCTED ON THE ROCKY MOUNTAIN ARSENAL

4.0

KNOWN ARCHEOLOGICAL RESOURCES ON THE ROCKY MOUNTAIN ARSENAL

This chapter is a description of the known archeological resources on the Rocky Mountain Arsenal. Information about the resource type, its research implications, and its management implications is provided in tables and discussed in the text. This task is relatively simple because within the arsenal's boundaries, only one archeological site has been recorded.

The archeological resource that has been recorded is an archeological site listed as 5AM185 (Table 4-1). This site is a lithic scatter of chipped stone debitage, ground stone fragments, and a hammerstone-chopper tool. Diagnostic stone tools have been removed from the site by relic collectors. 5AM185 was probably a short term campsite, based on inferences made using the surface materials observed on the site. The site was recorded in April, 1982 and has been recommended to be eligible for nomination to the National Register of Historic Places (Johnson 1982). Neither the State Historic Preservation Officer (SHPO) nor a formal governmental agency has concurred with this recommendation (Table 4-1). Based on the facts that no ceramics were observed on the site and that a large projectile point had been collected earlier from the site, the site was dated to the Middle Archaic (Table 4-2). Locational data for 5AM185 are provided in Table A-1.

Site 5AM185 has not been surface collected in a systematic manner, so no collections of artifacts or ecofacts have been made. The only information concerning this site exists in the site form located at the Office of the State Archaeologist, Colorado (OSAC) and in a small report prepared by Ann Johnson (1982) of the National Park Service, Rocky Mountain Regional Office, Denver. No archeological collections from sites on Rocky Mountain Arsenal exist in any museum or local historical and/or archeological societies. It is possible that arsenal employees have made collections from other cultural resource locations on the facility, but this would have to be verified by personal interviews.

Potential archeological site locations were searched for by studying historic and ethnographic literature which indicate where events and/or activities occurred. Individuals at Rocky Mountain Arsenal were questioned about cultural resources within the arsenal's boundaries, but no additional prehistoric archeological site locations were known. The literature search for potential archeological cultural resource locations did not reveal any locations.

Table 4-1. PRESENTLY IDENTIFIED ARCHEOLOGICAL RESOURCES ON THE ROCKY MOUNTAIN ARSENAL: ADMINISTRATIVE DATA

Site Number[a]	Site Recorder[b]	Date of Site Record	SHPO Survey Number[c]	Site Record Repository[b]	Survey Collection Policy[d]	Current Status of Investigation[e]	NRHP Status[e]	State, Local Status[f]	Architectural Association	Bibliographic Reference
5AM185	OSAC	9/4/82	None	OSAC	N, CS	REF, RAS	REP	None	None	Johnson 1982

[a] Site registration numbers are a trinomial designation following a system set up by the Smithsonian Institution in the late 1940s. The first segment of the trinomial is a numerical label for the state (e.g., Colorado = 5), the second segment is a two-letter abbreviation for the county (e.g., AM = Adams), and the final segment is a sequential identification of the sites registered within that county and state. Site locational data are provided in Table A-1, and are mapped in Figure A-1.

[b] OSAC = Office of the Colorado State Archeologist, Colorado Historical Society, Denver.

[c] No survey registration number has been assigned by the Colorado State Historic Preservation Office.

[d] Collection policies of the survey identified here were to collect nothing (N); and surface collection without location mapping (CS).

[e] Levels of archeological site investigation to date, and current site status, include filing of an inventory record (REF), scientific excavation as research not part of a mitigation program (SER), scientific excavation as part of a mitigation program (SEM). and/or the need for further study and evaluation (RAS).

[f] REP = recommended as eligible for the National Register of Historic Places (NRHP) by qualified professionals with no formal agency or SHPO recommendation.

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Table 4-2. PRESENTLY IDENTIFIED ARCHEOLOGICAL COMPONENTS ON THE ROCKY MOUNTAIN ARSENAL: DESCRIPTION AND EVALUATION

	Unit Age				Unit Description							Evaluation			
	Date		Temporal Unit						Dimension						
Site Number	DM[a]	Years BC/AD	Tradition	Phase (Period)	Artifacts[b]	Features[c]	Depositional Context	Landform	Area (m^2)	Depth (m)	Ascribed Function	Percent Intact	Value Integrity[d]	RV[e]	CR[f]
5AM185	REL	3500 to 1000 BC	Plains	Middle	FL, GS	FCR	Surface	Hilltop	1200	.15	Campsite	50-60	LDMWA	2	2

[a] Dating methods (DM) are relative (REL) based on artifact attributes.

[b] FL = flaked lithics, which may or may not be accompanied by hammerstones of other flaking stone tools; GS = ground or grinding stones, which may or may not be accompanied by polished stone artifacts.

[c] FCR = fire-cracked rock.

[d] National Register of Historic Places evaluation criteria; L = location, D = design, M = materials, W = workmanship, A = association.

[e] This is a subjective summary assessment of the overall research value (RV) of the identified components. It is an evaluation of the resources quality of preservation, representation of activity diversity or uniqueness, and temporal distinctiveness or reflection of diachronic relationships. It incorporates the need to avoid triviality, but to acquire what may be redundant data so as to discern patterns among those data. Research values are ranked from 0 (no value) to 5 (highest value).

[f] This is a rating of the confidence (CR) the authors have in the previously assigned research values (RVs). 1 = judgement is more guess than science, and likely not to be reliable; 2 = judgement is moderately reliable; 3 = judgement is most likely to be reliable.

Failure to specify potential archeological resource locations in this report does not mean that no additional prehistoric cultural resources can be found in the undisturbed portions of Rocky Mountain Arsenal. Rather, it means that a search of the relevant literature and limited discussions with arsenal employees did not provide any information concerning the location of potential archeological cultural resources.

There are nine potential historical resource locations in the southern portion of the Rocky Mountain Arsenal (Table 4-3). These potential historical sites are shown on Figure A-1 and their locational data are listed in Table A-1. Information regarding their location and approximate age was taken from maps (Colorado Aerial Photo Service 1982; Rocky Mountain Arsenal 1978) of the Rocky Mountain Arsenal and from Mr. James Bucholtz (personal communcation, 1983), Civil Engineer at the arsenal. The potential sites may still contain domestic refuse associated with residences constructed prior to the establishment of the Rocky Mountain Arsenal. A small school building (RMA-7, Table 4-3) was also once present on the arsenal property. Other features, including wells, privies, and subsurface structural remnants may also be found at these potential historical resource locations. Other historical references, including county, arsenal and national archives, should be reviewed to establish a more complete historical overview of the Rocky Mountain Arsenal.

Six of the nine potential historical resources were torn down when the arsenal began operations in the 1940s. Three homestead houses (RMA-3, RMA-4, RMA-5) are still used for family housing by the Rocky Mountain Arsenal (Rocky Mountain Arsenal 1978), but these structures have been remodeled many times in the last 40 years (James Bucholz, personal communication 1983).

Table 4-3. POTENTIALLY IDENTIFIABLE BUT NOT PRESENTLY RECORDED ARCHEOLOGICAL RESOURCES ON THE ROCKY MOUNTAIN ARSENAL

Site Number, Name[a]	Reference		Description	Research Value CR[b]
RMA-1	Colorado Aerial Photo Service	1982	Homestead	2
RMA-2	Colorado Aerial Photo Service	1982	Homestead	2
RMA-3	Rocky Mountain Arsenal	1978	Homestead	2
RMA-4	Rocky Mountain Arsenal	1978	Homestead	2
RMA-5	Rocky Mountain Arsenal	1978	Homestead	2
RMA-6	Colorado Aerial Photo Service	1982	Homestead	2
RMA-7	Rocky Mountain Arsenal	1978	Schoolhouse	2
RMA-8	Colorado Aerial Photo Service	1982	Homestead	2
RMA-9	Colorado Aerial Photo Service	1982	Homestead	2

[a] Site numbers were assigned by the author within the context of this overview and management plan. The numbers were sequentially assigned across the facility. Table A-2 provides their locational information, and they are illustrated in Figure A-2.

[b] The Confidence Rating (CR) of the potential resource base's research value is a general assessment (based on available data) of the authors' confidence in the site's physical integrity and value (e.g., representation of activity diversity or uniqueness, temporal distinctiveness or reflection of diachronic relationships, representativeness). The CR is a ranked assessment: 1 = the site is likely to have little value or the information about it is too unreliable for making a value judgement; 2 = the resource may have research value and the authors are moderately confident that the information about it is reliable; 3 = the resource is likely to have high research value and the authors are quite confident that the information about it is reliable.

5.0 AN ASSESSMENT OF THE SIGNIFICANCE OF THE ARCHEOLOGICAL RESOURCE BASE ON THE ROCKY MOUNTAIN ARSENAL

The preceding sections of descriptive information are synthesized in this section. This synthesis provides the cultural resource planner with the important research values of the presently known and predicted cultural resource base.

5.1 THE SIGNIFICANT RESOURCE BASE

Cultural resources must be organized into categories which reflect scaled values of importance for scientific research questions, or scaled values of current sociocultural concerns. Table 5-1 summarizes the organization of cultural resources which occur or are likely to occur at the Rocky Mountain Arsenal. Cultural resources are categorized by major cultural periods and thematic units within those periods (Table 5-1).

The lack of recorded cultural resources on arsenal property reflects the lack of cultural resource surveys in the area. All cultural resources that are likely to be located on the arsenal have a relatively high research value (Table 5-1). Highest research values were assigned to Selby-Dutton period and Early Archaic period cultural resources. These materials are rarely found and represent significant archeological research information. Very high research values were given to Clovis, Folsom, Plano, Middle Archaic, Middle Ceramic, and the Ethnohistoric period cultural resources. These cultural resources have not been found in the immediate area of the arsenal and their presence would represent important scientific data in analyzing Colorado Plains prehistory. Especially important in this respect are Archaic and Ceramic period sites because so little is known about this period on the Colorado Plains. In a similar way, Ethnohistoric period cultural resources are important because these materials represent a time of significant subsistence change (pedestrian to equestrian hunting/gathering), and they could be correlated with named Native American tribes living in the area. In general, the prehistoric cultural resources on the Rocky Mountain Arsenal are important from a research perspective because relatively little prehistoric archeological research has been conducted in the area. Urban expansion has destroyed many cultural resources before their information could be recorded. Those places (such as the Rocky Mountain Arsenal) which contain areas minimally impacted by recent construction are critically important for providing optimal information about local prehistory and history.

Table 5-1. SUMMARY OF SIGNIFICANT ARCHEOLOGICAL RESOURCES ON THE ROCKY MOUNTAIN ARSENAL

Temporal Unit	Thematic Unit	Resource Type	Type Occurrence[a] Known Occurrences (no.)	Type Occurrence[a] Potential Occurrences (no.)	Type Occurrence[a] Other Likely Occurrences	Sociocultural Association	Landform Association	Physical Integrity	Research Value[b]	RV CR[c]	Sociocultural Value[d]	SCV CR[c]
Historic Period	Ranching/Farming	Homesteads, irrigation	0	0	+	Euroamerican	Open plain	Fair	3	2	2	2
	Homestead/Tourism	Isolated homestead, irrigation	0	0	+	Euroamerican	Foothills; open plains	Fair	3	2	4	2
Ethnohistoric	Equestrian hunting/ gathering	Tipi ring, campsite	0	0	+	Native American	Terrace hilltop	Fair	4	2	3	2
	Equestrian hunting/ gathering	Tipi ring,	0	0	+	Native American	Terrace hilltop	Fair	4	2	3	2
	Pedestrian to equestrian hunting/ gathering	Pithouse, village, habitation site	0	0	+	Native American	Terrace	Fair	4	2	3	2
Middle Ceramic	Seasonal hunting/ gathering	Hunting base camp	0	0	+	Native American	Terrace/bench; knolls	Fair	4	3	3	2
Early Ceramic	Seasonal hunting/ gathering	Burials; campsites	0	0	+	Native American	Knolls; springs minor drainages	Fair	4	3	3	2
Late Archaic	Seasonal hunting/ gathering	Campsite	0	0	+	Native American	Terrace/bench; hilltop	Fair	4	3	3	2
Middle Archaic	Seasonal hunting/ gathering	Campsite	1	0	++	Native American	Terrace/bench; hilltop	Fair	4	3	3	2
Early Archaic	Seasonal hunting/ gathering	Campsite	0	0	+	Native American	Terrace/bench	Fair	5	3	3	2
Plano	Big game procurement	Kill and butcher site	0	0	+	Native American	Arroyo; dune	Fair to poor	4	3	3	2
Folsom	Big game procurement	Kill and butcher site	0	0	+	Native American	Arroyo	Fair to poor	4	3	3	2

Table 5-1. SUMMARY OF SIGNIFICANT ARCHEOLOGICAL RESOURCES ON THE ROCKY MOUNTAIN ARSENAL (concluded)

Temporal Unit	Thematic Unit	Resource Type	Type Occurrence[a] Known Occurrences (no.)	Potential Occurrences (no.)	Other Likely Occurrences	Sociocultural Association	Landform Association	Physical Integrity	Research Value[b]	RV CR[c]	Sociocultural Value[d]	SCV CR[c]
Clovis	Big game procurement	Kill and butcher site	0	0	+	Native American	Basin, spring	Fair	4	3	3	2
Selby-Dutton	Big game procurement	Kill and butcher site	0	0	++	Native American	Basin, spring	Fair	5	3	3	2

[a] The number of presently known or potential archeological resources of this type is specified here. In addition a judgement has been made as to the likelihood that other members of this resource occur within the facility, based on an analysis of the ethnohistoric or historic land use patterns and/or a review of the landform patterning of prehistoric materials. The probability of these additional occurrences has been noted as negative (-), positive (+), or highly positive (++).

[b] This is a subjective summary assessment of the overall research value (RV) of the resource class. It is an evaluation of the class' quality of preservation, representation of activity diversity or uniqueness, and temporal distinctiveness or reflection of diachronic relationships. It incorporates the need to avoid triviality, but to acquire what may be redundant data so as to discern patterns among those data. Based on these research values, the resource classes under discussion are ranked from 0 (no value) to 5 (highest value), including "NA" if such an evaluation is believed to be impossible given the available information.

[c] The Confidence Rating (CR) is a further evaluation of the perceived reliability of the research (RV) or sociocultural (SCV) values of the resource class. 1 = the judgement is more guess than science, and likely not to be reliable; 2 = the judgement is moderately reliable; 3 = the judgement is most likely reliable.

[d] This is a subjective summary assessment of the overall sociocultural value (SCV) of the resource class. It is an evaluation of the social, religious, or political importance of the resource to a contemporary community, from 0 (no value) to 5 (highest value).

5.2 IDEAL GOALS AND OBJECTIVES

Given the assumption that significant (and presently unidentified) archeological resources are located within the arsenal, the following is an outline of a desirable program to manage these resources for the best preservation or use of their research and sociocultural values. An ideal arsenal archeological resource management program would encompass identification, evaluation, conservation, excavation and analysis, and interpretation activities. It would emphasize the conservation of significant resources, and their excavation or "use" only to mitigate any unavoidable destruction or damaging activities or in search of important information that is being collected and studied within a well designed research project.

Since no archeological resource surveys have occurred on the Rocky Mountain Arsenal, the first step in developing a management program is field identification of the sites predicted to be there. Such an identification program should begin with a more intensive and extensive review of oral and archival historic information. The focus of this preliminary review would be to evaluate the historical information base presently available without recourse to any historical archeological investigations, and through consultation with professional historians and people with personal ties to the pre-1942 occupants evaluate the historic significance of any materials that might be left on the arsenal. This would complement the more extensive evaluations of natural resource distributions presented within this report as the basis of evaluating the distribution and potential significance of any prehistoric archeological resources there.

The second stage of the identification program would be the field inventory of the undisturbed portions of the arsenal to identify the surface evidence of any historic or prehistoric archeological sites. Such an identification project would include the pedestrian survey of the arsenal, with close-interval spacing of survey transects. Large-scale aerial photographs and detailed topographic maps should be used for field reference. Standard forms for recording the surface characteristics of identified prehistoric and historic resources should be completed as part of the inventory procedures and the area and methods of the survey should be well documented. The preferred survey policy for most contemporary projects is to make only minimal collections of artifacts off of site surfaces, retaining only those that are diagnostic of particular styles and/or technologies or are immediately vulnerable to non-professional collection or damage. Any collected materials should be fully described and appropriately curated.

In addition to a description of the surface evidence of these sites, the ideal inventory would include some kinds of subsurface investigation (e.g., augering, test excavation, remote sensing) to evaluate the contents, extent, and integrity of the identified resources. Finally, this stage should include an identification of the important research or other

values inherent in the inventoried sites, both as a basis for the development of future research designs as well as for the evaluation of management options should the resource be threatened with damage or destruction by non-archeological-research activities. For purposes of future research development, the identification and evaluation of the resources needs to be well documented and available to the research community. For future resource management purposes, it needs to be appropriately stated within the U. S. Department of the Interior's terminology and concepts of resource significance.

The prevailing professional approach to archeological resources for the past decade has been one of conservation (Lipe 1977:21)--"Our goal... is to see that archaeological resources everywhere are identified, protected, and managed for maximum longevity." Thus, the ideal objective is to develop a "bank" of significant sites that may be investigated through a variety of techniques, including destructive excavation, only as part of well designed research projects that are scheduled within a regional research program that seeks to maintain the overall range of undisturbed sites for future use. A corollary to this is that the sites should be allowed to be investigated by scientists in a non-reactive situation (i.e., not threatened with immediate destruction of the resource). Such basic investigation of resources on the public lands should be conducted only within research designs that are appropriate to the contemporary regional or broader study questions. It should also be conducted only within a program that includes long-term protection of the information collected from the resources, and a commitment to the public dissemination of that information.

If an archeological site evaluated as being of research or sociocultural significance is going to be damaged or destroyed, the ideal objective would be to preserve its included materials and information values through a "salvage" or "data recovery" program. Such a program would be little different from the non-reactive investigations discussed above, but is likely to be conducted in emergency situations with requirements for immediate recovery. Again, an important element in such an emergency research program would be the adequate analysis, curation, and publication of the recovered information.

Thus, in summary the ideal goals for the management of Rocky Mountain Arsenal archeological resources are to:

- Inventory and evaluate all the resources on the facility
- Conserve the significant sites, allowing their research use only within a regional research design
- Recover the contents and information from any significant resources threatened by damage or destruction
- Provide the public with the substance of the information values that are inherent within or collected from the arsenal's archeological resource base.

6.0
A RECOMMENDED ARCHEOLOGICAL MANAGEMENT PLAN FOR THE ROCKY MOUNTAIN ARSENAL

Given the known, potential, and likely cultural resources on the Rocky Mountain Arsenal, the following management plan provides the basis for explicit and useful decisions concerning impacts on cultural resources. The following sections outline the Rocky Mountain Arsenal master plan, appropriate goals, and an estimated scope of work and cost-levels for the identified management needs.

6.1 FACILITY MASTER PLANS AND PROPOSED IMPACTS

There is no long-term planning document for the Rocky Mountain Arsenal, but rather a process of planning that depends on federal appropriations. The appropriations can come from the annual Operations Maintenance (OMA) funds or from additional funding for special projects. The Military Construction-Army (MCA) funding and Military Construction Army Reserve (MCAR) funding are two examples of additional types of funding for construction at the Rocky Mountain Arsenal. Other projects proposed for the arsenal are submitted to the Department of the Army before being considered for funding.

A summary of on-going and planned ground disturbing activities (Table 6-1, Figure 6-1) includes the affected cultural resources and the potential impacts. The summary is based on conversations held with James Bucholtz and David Heim of the Rocky Mountain Arsenal civil engineering and planning section.

The Rocky Mountain Arsenal is contemplating, through OMA, two projects: removal of contaminants from Upper Derby Lake (RM-0192-83) and from Lower Derby Lake (RM-0198-83), but these are not yet funded. Rocky Mountain Arsenal has received funding through MCA for three land altering projects: movement of dikes near Basin "F", in order to facilitate evaporation (81 B0233); construction of a liquid waste disposal facility, the Northwest Boundary Containment/Treatment System (DACA345 83B0071); and numerous small renovation projects in the South Plants Area and Basin "A." In addition, the MCAR funding docket contains two cleared projects: AMSA/OSA Maintenance Building (DACAY1-82-C-0235), and an Army Reserve Center (MRD-86-MCAR-68). The AMSA/OSA Maintenance Building has been built.

0172D-1

Table 6-1. A SUMMARY OF ON-GOING AND PLANNED ACTIVITIES ON THE ROCKY MOUNTAIN ARSENAL THAT COULD AFFECT ARCHEOLOGICAL RESOURCES

Activities						Associated Resources				Impacts		
Description	Date	Area[a]	Size (a.)	Estimated Depth Below Surface (ft.)	Ratio of Disturbed to Total Area[b]	Resource Class[c]	Resources Known or Predicted[d]	NRHP Status[e]	Other Value[f]	Direct[g]	Indirect[h]	Mitigation Options
Removal of contaminants from Upper and Lower Derby Lakes	1983	A	359	6	8:10	NA	NA	NA	NA	NA	NA	NA
Movement of dikes in Basin F	1984(?)	B	172	2-6	4:10	NA	NA	NA	NA	NA	NA	NA
Construction of Liquid waste disposal facility	1983	C	60	10	6:10	Paleo-Indian	L	INSF	No	Destroy resources	NA	Archeological data recovery
						Plains Archaic	L+	INSF	No	Destroy resources	NA	Archeological data recovery
						Plains Woodland	L+	INSF	No	Destroy resources	NA	Archeological data recovery
Renovation of South Plants and Basin A	1983D	648	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
AMSA/OSA maintenance	1983	E	6	4-6	7:10	Plains Archaic	L	INSF	No	Destroy resources	NA	Archeological data recovery
						Plains Woodland	L	INSF	No	Destroy resources	NA	Archeological data recovery
Construct Army Reserve Center	1984	F	6	4-6	7:10	Plains Archaic	L	INSF	No	Destroy resources	NA	Archeological data recovery
						Plains Woodland	L	INSF	No	Destroy resources	NA	Archeological data recovery
						Plains Village	L	INSF	No	Destroy resources	NA	Archeological data recovery
Post Office expansion	n.d.	G	116	8-10	7:10	Plains Archaic	L++	INSF	No	Destroy resources	NA	Archeological data recovery
						Plains Woodland	L++	INSF	No	Destroy resources	NA	Archeological data recovery
						Plains Village	L	INSF	No	Destroy resources	NA	Archeological data recovery
						Historic	L++	INSF	No	Destroy resources	NA	Archeological data recovery

Table 6-1. A SUMMARY OF ON-GOING AND PLANNED ACTIVITIES ON THE ROCKY MOUNTAIN ARSENAL THAT COULD AFFECT ARCHEOLOGICAL RESOURCES (Concluded)

Activities						Associated Resources				Impacts		
Description	Date	Area[a]	Size (a.)	Estimated Depth Below Surface (ft.)	Ratio of Disturbed to Total Area[b]	Resource Class[c]	Resources Known or Predicted[d]	NRHP Status[e]	Other Value[f]	Direct[g]	Indirect[h]	Mitigation Options
Army Training Area	n.d.	H	4480	1 3	2:10	Paleo-Indian	L	INSF	No	Destroy resources	Area more accessible	Data recovery and protection
						Paleo Archaic	L++	INSF	No	Destroy resources	Area more accessible	Data recovery and protection
						Plains Woodland	L++	INSF	No	Destroy resources	Area more accessible	Data recovery and protection
						Plains Village	L++	INSF	No	Destroy resources	Area more accessible	Data recovery and protection
						Historic	L+	INSF	No	Destroy resources	Area more accessible	Data recovery and protection

[a] Locations of these areas are mapped in Figure 6-1.

[b] Not all the ground within the boundaries of an on-going or proposed activity area will necessarily be affected. This Ratio is an evaluation of the acres of surface projected to be disturbed within a proposed activity area in proportion to the overall size of the area itself.

[c] This is a synthetic statement of temporal unit + thematic unit + resource type, as presented in Table 5-1; not applicable (NA).

[d] This is an identification of the Known or Potential resources that are located within the proposed activity area, as well as the positive (+) chance that presently unknown resources are likely (L) to be found there; if category not applicable, indicated as NA.

[e] The National Register of Historic Places (NRHP) status of the resource is identified by the following code. INSF = Insufficient information available by which to make a judgement; not applicable (NA).

[f] Other values may include concerns such as traditional Native American religious significance, local zoning requirements; not applicable (NA).

[g] Direct impacts are those whose ground-disturbing activities will directly damage or destroy the identified resource; not applicable (NA).

[h] Indirect impacts include activities such as vandalism because of increased knowledge of a resource, increased erosion of a resource because of project-related activities (e.g., loss of vegetative cover), or loss of structural integrity of surface or buried structural elements because of increased traffic vibration; not applicable (NA).

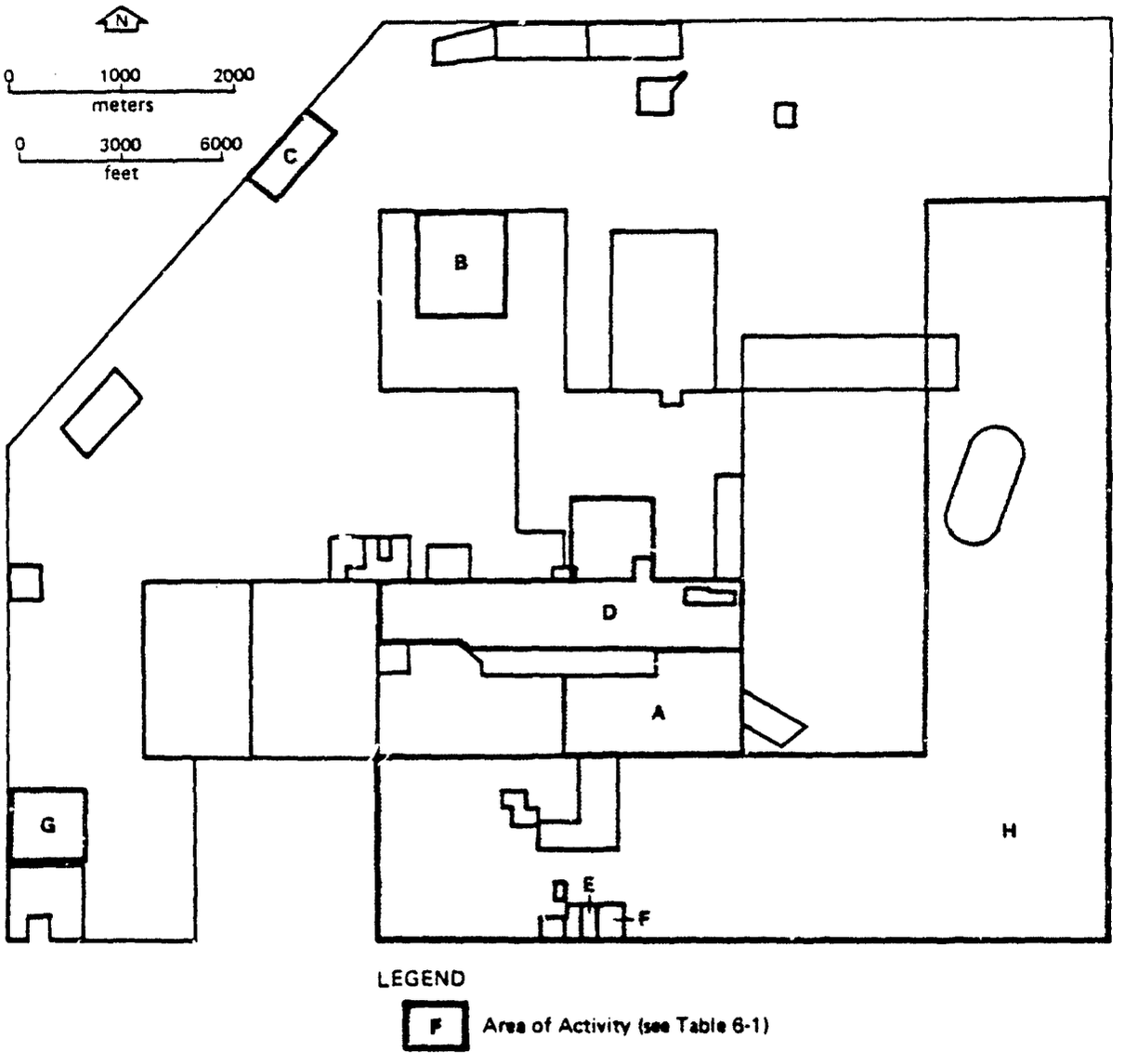

Figure 6-1. LOCATION OF ON-GOING AND PLANNED ACTIVITIES ON THE ROCKY MOUNTAIN ARSENAL

Two more projects are being considered by the Department of the Army: to allow the Postal Service to double its leased property holdings in Section 9; and to turn Sections 5, 7, 8, 11, 12, 19, and 32 into a Training Area (LTA) for Army Reserve training activities. Since these projects are only being considered at this time, no funding has been appropriated for them.

6.2 APPROPRIATE ARCHEOLOGICAL MANAGEMENT GOALS WITHIN THE ARSENAL

This section is a presentation of appropriate and effective cultural resource management objectives for the Rocky Mountain Arsenal. Two general topics--the arsenal's broad planning needs and the arsenal's specific needs based on projected land disturbing activities--form the basis of management objectives.

6.2.1 General Facility Planning

Army Regulations 420, drafted pursuant to the National Historic Preservation Act and 36 CFR 800 (Section 1.1) require that each DARCOM installation have a Historic Preservation Plan or have documentation on file indicating that there are no installation resources appropriate to such management planning. At present, there is no such negative declaration and at least one archeological site is known to exist on the facility. Therefore, the present report is organized so as to provide a basis for such a Plan to be developed and implemented on the facility.

Department of the Army AR 420 regulations prescribe Army policy procedures and responsibilities for compliance with the National Historic Preservation Act of 1966, as amended; for the maintenance of state-of-the-art standards for preservation, personnel and projects; and for accomplishment of the historic preservation program (Figure 6-2). The Historic Preservation Plan has the following objectives:

- Provision of historic and archeological data for the installation's information systems
- An outline of priorities for acquiring additional information to determine if there may be additional projects not yet located or identified
- Establishment of a procedure for the evaluation of historic properties
- Provision of guidelines for the management of historic properties
- Implementation of a legally acceptable compliance procedure with the Advisory Council for Historic Preservation (ACHP) and the State Historic Preservation Office (SHPO)

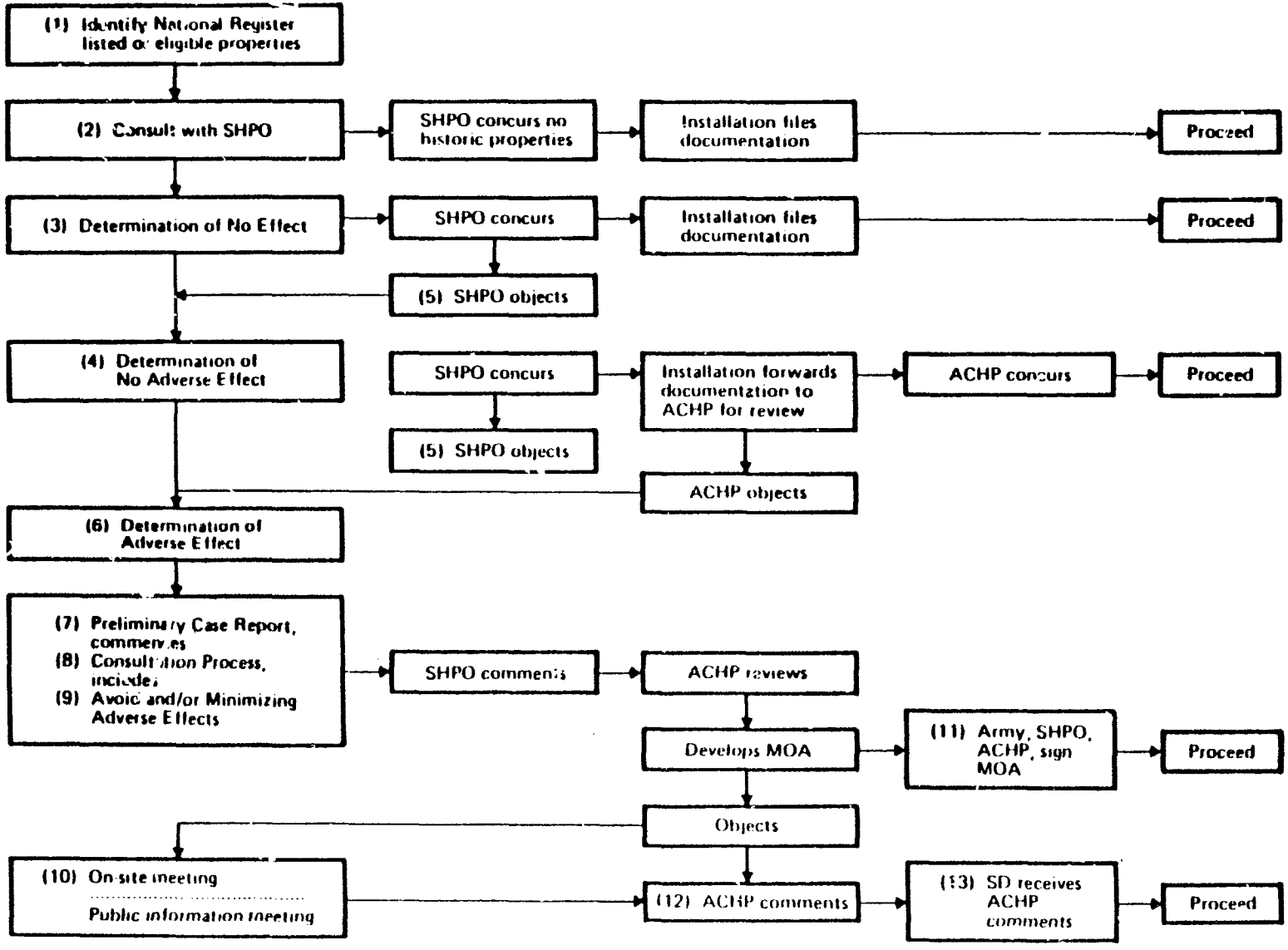

Figure 6-2. PROCEDURE FOR COMPLIANCE WITH REGULATIONS OF THE ADVISORY COUNCIL, IN ACCORDANCE WITH 36 CFR 800 (AR 420, Figure 1)

- Integration of historic preservation requirements with the planning and execution of military undertakings such as training, construction, and real property or land use decisions

- Ranking of facility projects by their potential to damage historic properties

- Identification of funding, staffing and milestones needed to implement the plan.

The identification and evaluation of historic and prehistoric resources on the AAP has been initiated by the completion of this overview and plan (as well as the identification of site 5AM185). This needs to be followed by a full identification and evaluation program as outlined in Section 5.2: more extensive oral and archival historic review; field surface and subsurface inventory of all undisturbed arsenal lands; evaluations of resource significance in terms of U. S. Department of the Interior criteria. Some or all of this recommended work could be postponed until there is a specific ground-disturbing project that requires compliance with the National Historic Preservation Act (see Sections 1.1, 6.2.2), if development of a historic preservation plan more specific than this document is also to be postponed and if such scheduling has been accepted by the Colorado State Historic Preservation Office (SHPO).

Under any schedule, until the determination has been made that identified prehistoric or historic sites are <u>not</u> significant they must be managed as if they were, for compliance with Section 110(a)(2) of the National Historic Preservation Act:

> (2) With the advice of the Secretary [of the Interior] and in cooperation with the State Historic Preservation Officer for the State involved, each Federal agency shall establish a program to locate, inventory, and nominate to the Secretary all properties under the agency's ownership or control by the agency, that appear to qualify for inclusion on the National Register in accordance with the regulations promulgated under section 101(a)(2)(A). Each Federal agency <u>shall exercise caution</u> to assure that any such property that might qualify for inclusion is not inadvertently transferred, sold, demolished, substantially altered, or allowed to deteriorate significantly [underlining added].

Under this guidance we recommend that the one identified prehistoric site on the Rocky Mountain Arsenal, which has been professionally evaluated but not formally determined to be eligible for the National Register, be managed as if it were Registered. We suggest that this management include avoidance of the site by any authorized ground-disturbing activities, and monitoring of the area to restrict its being vandalized.

As outlined in the previous discussion of ideal archeological management goals (Section 5.2), a recommended next stage in the assessment of

the importance of the facility's historic archeological resources is an intensive review of archival material and evaluation of regional historic research objectives. The archival review might focus on information stored in the National Archives and Records Service, as well as a more intensive review of Adams County land records, wills, and other pertinent documents and interviews of pre-1940s residents of arsenal lands. This review and evaluation should include consultation with the Colorado SHPO to identify and prioritize regional historic research questions to which the historic archeological information from identified sites might contribute. The goal of this research would be to define the historic significance that any of the identified sites might have if it had contextual integrity and was to be archeologically investigated.

As discussed in Section 5.2 and required by the National Historic Preservation Act (NHPA), the next step in the identification stage of archeological resource management should be field investigation to locate sites and determine their boundaries, contents, and integrity. NHPA Section 110(a)(2) requires that all federally owned or controlled lands be surveyed to identify all significant archeological properties on them. A strict adherence to this would support the immediate intensive archeological inventory of all Rocky Mountain Arsenal lands not previously surveyed or not clearly documented as having deep and extensive modern ground disturbance. The current prevailing federal policy about the implementation of this requirement is that it should be a "reasonable" program consistent with the overall schedules, budget, and multiple objectives of the land-managing agency. Given the planned construction activities itemized in Section 5.1, the high likelihood that there are significant prehistoric and historic archeological materials on the arsenal, and the frequent public discussions of the transfer of arsenal lands for expansion of Stapleton Airport, it is recommended that it would be most cost-effective to complete the archeological inventory of all undisturbed lands on the facility as soon as it is fiscally possible.

Based on the historic and field inventory information, the significance of all identified sites should be evaluated following criteria set forth in 36 CFR 60.6 and in accordance with guidelines from the Colorado SHPO. If sites are judged to be significant, a plan for their long-term management should be developed in the context of overall property management (including the management of any identified ethnohistoric or historic architectural/engineering resources). Such management activities might include resource conservation in place, biannual field review of site condition, public interpretation of resource values, scientific investigation of the sites, and/or planned site destruction by military activities. If significant sites are identified, it is recommended that the DARCOM officer responsible for the Rocky Mountain Arsenal operations provide the Colorado SHPO with the opportunity to review and comment on the proposed management plan. If the evaluation is made that none of the sites on the AAP is significant, filing of a report to that effect with the SHPO would complete the facility's compliance requirements for preservation planning.

6.2.2 Project-Specific Resource Protection or Treatment Options

Approximately 50 percent of the Rocky Mountain facility has been impacted by modern construction, and any future ground-disturbing activities in those areas is unlikely to need pre-construction review of their potential adverse impacts to significant archeological resources (the exception might be deep new excavation into previously undisturbed deposits beneath modern buildings or structures). However, new ground-disturbing construction on, or leasing of, arsenal land would be a federal undertaking requiring compliance with Section 106 of the National Historic Preservation Act (see Section 1.1 of this report). Section 106 requires that DARCOM consult with the Colorado SHPO and the federal Advisory Council on Historic Preservation about the effects of such an undertaking on significant archeological sites. Without a SHPO-accepted facility preservation plan, it is DARCOM's responsibility to either complete such an evaluation and consultation program for each new undertaking or to have on file documentation of the completion of adequate survey and evaluation so as to confirm the absence of or lack of significance of any archeological site that might be affected by the proposed activity.

Since the entire undisturbed portions of the arsenal have not been subjected to intensive archeological survey, construction or ground disturbance in areas currently unsurveyed could impact archeological resources. Consequently, if such impacts were planned, survey, evaluation, and perhaps required mitigative data recovery (scientific archeological investigation of a significant site) could be necessary on a project-specific basis prior to initiating the ground-disturbing activity. Such evaluation and preservation programs require consultation with several federal agencies, and are frequently time-consuming and have the potential for causing construction delays. However, such a project-specific program can usually be expedited if the appropriate preservation planning has been completed and reviewed by the State Historic Preservation Officer.

The following project-specific management program is based on the planned ground-disturbing activities on the Rocky Mountain Arsenal and their potential effects on the cultural resources likely to be affected. Much of the proposed activity will occur in areas already heavily disturbed (Areas A, B, D; Figure 6-1). On-site professional archeological monitoring is proposed for these areas, in light of the lack of overall arsenal archeological inventory data and in consideration of the cautions of the National Historic Preservation Act. On the other hand, previously undisturbed areas will be severely affected by the construction of the Army Reserve Center (F, Figure 6-1) and the Northwest Boundary Containment/Treatment System (C, Figure 6-1). Since there is a possibility that the U. S. Postal Service will increase its leased area in Section 9 (G, Figure 6-1) and that the Army Reserve may use all or portions of seven sections for a training area, (H, Figure 6-1), management plans are forwarded for these as well.

The activities that will not impact undisturbed cultural resources since the surrounding area has been heavily disturbed previously have resource categories listed as "NA" on Table 6-1. These areas (A, B, C, D, Figure 6-1) should be monitored by a professional archeologist during construction.

Three proposed (or potential) land-altering activities could affect archeological resources. In two of three cases (Areas F and G, Figure 6-1), construction will affect close to 100 percent of the ground surface. Direct impact of this activity is the destruction of the cultural resource(s). These areas should be surveyed before construction to inventory and evaluate any cultural resources in the projected area of impact. If significant cultural resources are found in the impact area, then the resources should be recovered before they are destroyed.

The third land-altering activity is a large training area for the Army Reserve (Area H, Figure 6-1). In this case the impacts will not cover all portions of the ground surface. The same archeological inventory program must be completed before Area H is turned into training areas. All cultural resources (archeological, historic architectural) in the affected sections of the Rocky Mountain Arsenal must be documented, and their significance evaluated. If significant sites are found in the proposed Army Training area, then two options exist: (1) recover all of the cultural resource information prior to the land altering activity; or (2) where appropriate, protect or conserve the cultural resource by posting signs, realigning potential tank movement areas away from the cultural resources, or by covering the cultural resources so that the training activities cannot hurt the cultural resources.

One ground-disturbing action (Area E, Figure 6-1) has already begun (June 1983) and is not presently in compliance with federal historic preservation requirements. This area should be monitored and/or examined as soon as possible to evaluate any possible impacts (direct or indirect) to cultural resources.

All of the project-specific management activities identified above should involve consultation with the State Historic Preservation Officer (SHPO) and with the federal Advisory Council of Historic Preservation (ACHP). If significant cultural resources are located in areas of projected disturbance and if these cultural resources are listed or are eligible to be listed on the National Register of Historic Places, then their significant values should be resources and/or protected before ground disturbance can begin.

6.2.3 A Summary of Recommended Management Directions and Priorities for Effective Compliance and Program Development

It is recommended that a professional archeological inventory and evaluation project be completed on all undisturbed portions of the arsenal's property as soon as possible. This is an appropriate response

to the requirements of Section 110 of the National Historic Preservation Act, and is a cost-effective management activity considering the number of planned ground-disturbing projects on the arsenal.

In complement to this survey it is further recommended that the Rocky Mountain Arsenal have a professional archeologist monitor ground disturbing actions for projects A, B, and D (Table 6-1 and Figure 6-1). Project E should be examined and archeologically monitored as soon as possible. Complete cultural resource inventory and evaluation is recommended for projects C and F in lieu of completing the recommended broad survey. There is a good possibility of locating undisturbed prehistoric and historic resources in these project areas. Two projects (G and H) are not yet funded but are under consideration by the Department of the Army. Should these projects be funded, a complete inventory and evaluation of cultural resources in these project areas is needed.

6.3 ESTIMATED SCOPES OF WORK AND COST LEVELS FOR PRESENTLY IDENTIFIABLE MANAGEMENT NEEDS

Each of the four management recommendations is presented here as a scope of work and an associated cost. The scope of work contains appropriate research topics to address, and the costs are in 1983 dollars.

6.3.1 Recommendation 1

The first management recommendation is the archeological inventory of all the undisturbed areas of the Rocky Mountain Arsenal. The survey would cover 8227 acres, the areas not previously affected by modern ground-disturbing activities (see Figure 3-1).

Such survey should be preceded by a more intensive archival and oral historical review project, which is estimated to require 20 work days. The archeological field inventory should be conducted by archeological professionals who meet the qualifications and performance guidelines of the U. S. Department of the Interior (1983) and the Society of Professional Archaeologists (1983) and hold a federal antiquities permit. The conduct of the inventory should generally incorporate methods as outlined in Section 5.2 - survey at close intervals, record all cultural resource locations on standard field recording forms, collect only diagnostic items or items in danger of immediate loss. All cultural resources should be evaluated for their research and sociocultural significance, and recommendations should be made concerning their eligibility for the National Register of Historic Places and appropriate management.

At a rate of 100 acres per work-day (assuming 5 sites per square mile), field operations are estimated to require at least 82 work-days to survey 8227 acres. If a higher density of cultural resources is encountered, additional field time may be required. The assumption does not include extensive subsurface investigations. Analysis of recorded information, preparation of site forms, and the completion of the final report will take approximately 165 work-days. This is a total estimated field

effort of 247 work-days, or 1976 work-hours. Costs of this technical field review and evaluation program, including all necessary travel (using local expertise), reference telecommunications, data management, and report preparation costs (but no general and administrative or departmental costs or fee or profit) generally average between $20 and $25 per work-hour across the country. Because of relatively greater use of senior expertise, archival programs (with similar assumptions) average between $25 and $30 per work-hour. Thus, given the potential cost of field activities, laboratory and special analyses costs, and the costs of report preparation, the unloaded cost of this optional management recommendation is between $43,520 and $54,200 in 1983 dollars. This cost is assumed to cover only routine involvement of the consultant with any state or federal review process.

The milestones for the recommended work would be, in sequence:

- Completion of Part I, a preliminary draft report on the archival and oral historic research documenting the potential relative importance of any historic archeological resources that might be found on the arsenal

- Completion of the archeological inventory and preliminary evaluation of identified archeological resources; completion of additional subsurface investigation of selected sites if necessary to support the evaluations

- Completion of Part II, a preliminary draft report on the field investigations and recommended evaluations and management program, for DARCOM review

- Completion of DARCOM review of the preliminary draft Parts I and II, as documented by a letter accepting them as appropriate for interagency consultation

- Completion of consultation (including both DARCOM representatives and the historical/archeological consultants) with the Colorado SHPO about the evaluations and recommended management, as documented in a letter of concurrence from the SHPO

- Completion of review of the DARCOM-submitted evaluations by the U. S. Department of the Interior's Keeper of the National Register, as documented in a letter of concurrence from the Keeper.

6.3.2 Recommendation 2

Management Recommendation 2 is the monitoring of construction/renovation activities in Areas A, B, D, and E (Figure 6-1). The ground-disturbing work is made up of the following projects: RM-0192-83, RM-0198-83, 81 E0233, DACY1-82-C-0235, and the many small projects in the South Plant and Basin "A."

The scope of work requires monitoring of four impact areas during construction/ground-disturbing activities. Area A (Figure 6-1) is 359 acres, Area B (Figure 6-1) is 172 acres, and Area D (Figure 6-1) is 648 acres. Most of the proposed effort in Area D will be renovation of now-standing structures. Monitoring will require some preliminary archival and oral historic research on-site examination during construction, and should be done by professional archeologists who meet the previously cited standards. All ground-disturbing activities will be watched to identify any discovered cultural resources; if cultural resources are encountered, they should be evaluated and appropriately treated before construction is continued. Cultural resources found in these areas may be disturbed and have little or no integrity. However, should potentially significant artifacts or features and/or human remains be uncovered, the importance of those resources and their appropriate treatment needs should be evaluated before continuing construction. Any discoveries of human remains should be handled following the U. S. Department of the Interior (1982) guidelines for the treatment of burials.

The minimal time frame for the monitoring of activities with a two-person crew, based on an assumption of about 50 acres per crew day, is estimated as follows:

Area A	359 acres	14 work-days
Area B	172 acres	6 work-days
Area D	648 acres	8 work-days
Area E	6 acres	2 work-days

Area D has very little ground disturbing activity. The time parameters are estimates, and the specific land modification plans should be reviewed before preparing the final scope of work.

Overall minimal effort is estimated to be five historic review work-days and 30 work-days in the field, though the amount of time involved would first be a function of general construction schedules. Another 30 work-days should be allocated for reporting the results of the monitoring activity, and should be viewed as lower limit based on the assumption that only a small number of cultural materials are found and no major data recovery is involved. The report would be a brief account of the activity and any results. Scheduling is straight-forward as long as the ground disturbance activities do not occur at once. Ideally the projects should be scheduled to allow the cultural resources specialist time to complete each area separately.

Under the assumptions as stated above, this effort is estimated to require a minimum of 65 work days and could increase exponentially, if construction schedules create increased mobilization costs and/or data recovery is required. Estimated unloaded cost for 65 work-days of effort at an average of $15 to $20 per work hour, allowing for travel, per diem, report preparation, and benefits is estimated to be between $7800 and $10,400 in 1983 dollars.

Under the assumption that no significant archeological resources are found during the monitoring, general milestones for this activity would include, in sequence:

- Completion of preliminary archival and oral historical research, as documented in technical file memos and references
- Completion of the archeological monitoring program
- Completion of a report of the preliminary review and monitoring activities, and its acceptance by DARCOM
- Filing of the report with the Colorado SHPO.

If materials are encountered during monitoring that appear to be eligible for listing on the National Register, the monitoring program could include these milestones:

- Preliminary identification of the resource in the middle of construction
- Construction halt until the materials are either judged to be unimportant, or are professionally recovered as a mitigative measure; this could involve in-field consultation with the Colorado SHPO and the U. S. Department of the Interior Departmental Archeologist or his designee.
- If important materials are found, their description, analysis, curation, and reporting within the overall project report.

6.3.3 Recommendation 3

Management Recommendation 2 is the survey and inventory of Areas C and F (Figure 6-1). These areas will be used by projects DACA345 83B0071 and MRD-86-MCAR-68. A total of 66 acres of ground surface will be affected.

In lieu of the completion of Recommendation 1, the scope of work for Recommendation 3 is a complete survey of the 66 acres to inventory and evaluate the cultural resources affected by the planned construction actions. Such a survey and evaluation project should be conducted as described for Recommendation 1 and have similar milestones and cost/schedule assumptions.

Thus, this activity is estimated to require a minimum of nine person-days (72 work-hours at $20 to $25), for a total estimated unloaded cost of between $1440 and $1800 in 1983 dollars.

6.3.4 Recommendation 4

Should the Postal Service expansion and Army Reserve Training Area projects be funded, and in lieu of the completion of Recommendation 1, an

inventory and evaluation project is recommended for Areas G and H (Figure 6-1). The survey of these 4596 acres should be conducted as described for Recommendation 1 and have similar milestones and cost/schedule assumptions.

Field work here should be preceded by oral and archival historical research that is estimated to require 120 hours. At a rate of 100 acres per work-day (assuming five sites per square mile), 4596 acres can be inventoried in approximately 45 work-days. The descriptive analysis and final report preparation is estimated to require another 190 work-days. Thus, the overall unloaded cost of this recommended project is estimated to be between $3000 and $3600 for archival review, between $37,600 and $47,000 for other work, and thus to be between $40,600 and $50,600 for the overall effort (all in 1983 dollars).

7.0
SUMMARY

Prehistoric and historic archeological resources are known or judged likely to exist in the undisturbed portions of the Rocky Mountain Arsenal; 50 percent of the facility lands are estimated to be undisturbed by modern activity. Certain geomorphological contexts have the greatest probability for protecting the physical integrity of these prehistoric materials. Archeological resources in the area of the arsenal are poorly understood because urban expansion has destroyed many of them. The loss of this nonrenewable information elevates the importance of any resources that may be retained within the Rocky Mountain Arsenal. Prehistoric resources considered most critical are archeological sites of the Selby-Dutton and Early Archaic periods. Important research questions still remain for archeological resources assigned to the Paleo-Indian tradition, the Middle and Late Archaic periods, the Early and Middle Ceramic periods, and the Ethnohistoric period. These archeological resources should be carefully managed to insure that their potential information is not lost.

Compliance with the National Historic Preservation Act, the Archeological and Historic Preservation Act, 36 CFR 800, and Army regulations AR 420 requires the identification, evaluation, and where feasible affirmative management of significant prehistoric and historic archeological resources. These also require that federal undertakings (e.g., new construction, new leases or lease renewals of public lands) take into consideration the effects of the propcsed activities on significant archeological materials.

Thus, the first management recommendation of this report is that an archeological inventory and evaluation project be completed on all Rocky Mountain Arsenal lands not known to have heavy modern ground disturbance (8227 acres). All archeological resources that are evident there should be located, recorded, and evaluated. Where appropriate, significant sites should be recommended for nomination to the National Register of Historic Places. These inventory data, when integrated with historic architectural information, would be the basis for developing a facility historic preservation plan. The unloaded cost of such an inventory and evaluation program is estimated to range between $43,520 and $54,200 in 1984 dollars.

In lieu of completing such comprehensive inventory and evaluation, this report provides appropriate archeological management recommendations for planned land disturbance activities at the Arsenal. Current construction plans there include eight major projects. Four of these have either already begun or will occur in areas of the arsenal that have already been disturbed. It is recommended that these construction projects be monitored by a professional archeologist who will recover any archeological information encountered by the construction activities. These four construction areas total 1185 acres, and the estimated unloaded cost for this recommended monitoring is estimated to be between $7800 and $10,400 in 1983 dollars.

A third recommendation is that an inventory and evaluation survey be conducted on all those proposed construction areas that will be disturbed for the first time. Two projects affecting a total of 66 acres will completely disturb the surface and subsurface of areas that could contain archeological resources. The estimated unloaded cost of this recommended survey and evaluation project is between $1440 and $1800 in 1983 dollars.

If funding is approved for two more projects at Rocky Mountain Arsenal, then those 4596 acres should be archeologically inventoried and evaluated prior to construction. This large (but not arsenal-comprehensive) survey and evaluation is estimated to have an unloaded cost in 1983 dollars of between $40,600 and $50,600.

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APPENDIX

RESOURCE LOCATIONAL DATA

Table A-1. LOCATIONAL DATA, KNOWN ARCHEOLOGICAL RESOURCES ON THE ROCKY MOUNTAIN ARSENAL

Site Number[a]	UTM[b] Northing	UTM[b] Easting	UTM[b] Ref.	Legal Reference Township	Legal Reference Range	Legal Reference Section	USGS Quad Map[c]	CR[d]
5AM185	4411880	514210	OSAC	2S	66W	19	S76579	3

[a] Known resource locations are mapped in Figure A-1.

[b] UTM = Universal Transverse Mercator coordinates, Zone 13. If the area is less than 10 acres in extent, the coordinates record the approximate center of the site. The individual or institution that computed the UTM coordinates, listed here as "Ref.," is the Office of the Colorado State Archeologist (OSAC), Colorado Historical Society, Denver.

[c] Sable, CO 7.5 min. sheet (1965, photorevised 1979).

[d] The Confidence Rating (CR) is an evaluation of the perceived reliability of the site locational data. 1 = the information is more guess than science; 2 = the judgement is moderately reliable; 3 = the information is most likely reliable.

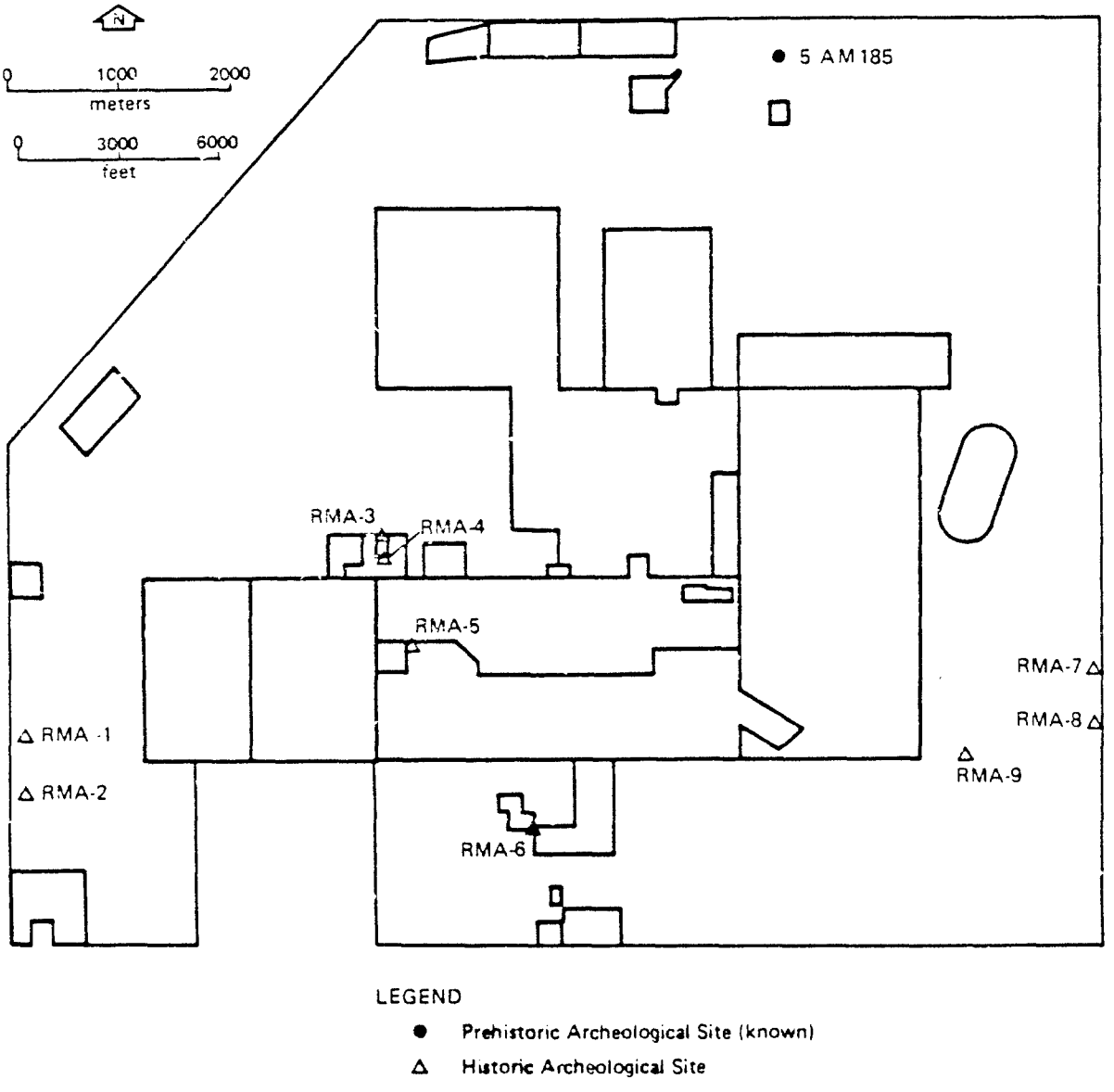

Figure A-1. MAP OF KNOWN AND POTENTIAL ARCHEOLOGICAL RESOURCES ON THE ROCKY MOUNTAIN ARSENAL

Table A-2. LOCATIONAL DATA, POTENTIAL ARCHEOLOGICAL RESOURCES ON THE ROCKY MOUNTAIN ARSENAL

Site Number[a]	UTM[b]			Legal Reference			USGS Quad Map[c]	CR[d]
	Northing	Easting	Ref.	Township	Range	Section		
RMA 1	4407340	508480	OSAC	T3S	R67W	5	S76579	2
RMA 2	4406540	508500	OSAC	T3S	R67W	9	S76579	2
RMA 3	4408680	511600	OSAC	T2S	R67W	35	S76579	3
RMA 4	4408600	511600	OSAC	T2S	R67W	35	S76579	3
RMA 5	4407800	511800	OSAC	T3S	R67W	2	S76579	3
RMA 6	4406100	512050	OSAC	T3S	R67W	11	S76579	2
RMA 7	4407580	517920	OSAC	T3S	R66W	5	S76579	3
RMA 8	4407060	517880	OSAC	T3S	R66W	5	S76579	2
RMA 9	4406900	516780	OSAC	T3S	R66W	5	S76579	2

[a] Potential resource locations are mapped in Figure A-1.

[b] UTM = Universal Transverse Mercator coordinates, Zone 13. If the area is less than 10 acres in extent, the coordinates record the approximate center of the site. The individual or institution that computed the UTM coordinates, listed here as "Ref.," include is the office of the Colorado State Archeologist (OSAC), Colorado Historical Society, Denver.

[c] Sable, CO 7.5 min. sheet (1965, photorevised 1979).

[d] The Confidence Rating (CR) is an evaluation of the perceived reliability of the site locational data. 1 = the information is more guess than science; 2 = the judgement is moderately reliable; 3 = the information is most likely reliable.